MAY 14 1923

Electrical World

McGraw-Hill Company, Inc.

May 12, 1923

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Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

Volume 81 — New York, Saturday, May 12, 1923 — *Number* 19

"Vice-President in Charge of Sales"

EXECUTIVES of central-station companies are beginning to appreciate more fully that their business, like any other, is built on the plan of a three-legged stool. The three legs which support it are finance, production and sales. Kick any one of these legs from under and the stool falls.

Since the beginning the attention of the executive has been closely, and naturally, focused on two legs mainly. He has been absorbed in the problems of engineering and operating—that is, production—and intent on financing—that is, raising money and meeting obligations. The sales leg—commercial management and public relations—has been a neglected, insecure one. But the stool has borne the weight upon it and the matter has had little thought.

Now comes a broader conception of the commercial opportunities and business obligations in the electrical industry. Bigger plans are forming. Greater expansion than ever is ahead. For the public *will* be served. And the development of a more general and intelligent equipment and electrification of buildings and industry, the development of a greater electrical merchandise market—in other words, the development of a more nearly universal application of electric service—presents an absorbing problem. More equipment and more appliances, which will use more energy and provide more service, are to be sold to industry, to agriculture and to the home. And naturally in each community the central station must lead in this work.

BUT this entire program means much more than just the selling of energy or appliances. The intelligent guidance and control of the expansion is the real issue. It is a problem of public relations, of community contacts. The need is thus for men rather than materials. And the important problem that confronts the president of the electric light and power company today is to strengthen the third leg of the stool by building up an adequate commercial organization that will go forward with the creative development of this greater market and service. Where he does not already exist in the president himself, the first need is for a commercial executive in every city who possesses the personality, the imagination and courage, the business experience and the commercial genius that will enable him to become the responsible head of this major activity of the business. In other words, the importance of the commercial division must be recognized, and it must be manned as effectively as are now the engineering and financial departments. The commercial executive of the central station is, moreover, the man who should make himself the head of the local electrical family, the leader and guide of all the electrical commercial activities in the town, working with a broad conception of the interest and service of the dealer, contractor, jobber and manufacturer as well as of his own company, to promote the expansion of the entire market for electric service and appliances. He should be a man of large caliber, a natural leader, able to win wide popularity without the sacrifice of proper dignity, amply qualified to take a prominent position among the influential business men of the community.

IT HAS long been customary for large and successful manufacturing enterprises to organize their personnel into these three departments of finance, production and sales. The problem of the central-station company is very similar, and the complete commercial function, embracing public and industry relations, customer contacts, publicity and selling, appears to be of sufficient magnitude to warrant its being headed, in the larger companies, by a "vice-president in charge of sales." In smaller organizations there should be a man no less appropriately titled and qualified to build sales and good will for the electrical industry.

Chief executives of central stations today can scarcely make any one move which will ultimately mean so much to the success of their business as to establish, where it has not already been done, commercial and public relations executives with the authority and support that will enable them enthusiastically and intelligently to develop the expansion of the industry. They will do this broadly in the public interest. Complete electric service will be brought into universal use, and the time to make adequate preparation is not some day—but now.

George Edward Miller

An exponent of the doctrine of a broad spirit of co-operation in business building for central stations.

THE city of Cleveland has long been rated as one of the most advanced centers of electrical development. As the home of an exceptionally enterprising central-station company and a large and very active group of electrical manufacturers, it early became the source of much of the promotional activity of the electrical industry, a proving ground for many new ideas in electrical development. The Cleveland Electric Illuminating Company has been the moving spirit throughout this interesting evolution and finally itself withdrew from the sale of appliances, with the idea of encouraging the local electrical merchants.

For the last twelve years the executive direction of electrical development in Cleveland has been in the hands of George E. Miller, sales manager of the Illuminating company. Possessing rare business judgment and tact, he has functioned in an advisory and co-operative capacity, but in effect he has been placed in the position of an active sales manager for the local electrical family. He was the first president of the Cleveland Electrical League and has devoted much of his time and energy through these years to planning and making possible the broad advancement of the electrical idea in Cleveland and the development of a greater prosperity for the electrical business there.

Mr. Miller was born on a farm near Weldon Spring, Mo., in 1872. He was graduated from the State University at Rolla, Mo., in 1895 and for two years was assistant instructor in the civil engineering department of its School of Mines and Metallurgy. For a time he was engaged in consulting and designing electric light and waterworks plants in Middle West states.

But the problems of market development appealed to him very strongly, and in 1899 he became a sales engineer in the St. Louis office of the Westinghouse Electric & Manufacturing Company. A year later he was transferred to the Westinghouse headquarters at Pittsburgh, and for a period of seven years he engaged in sales work and confidential activities for the vice-president. He was assigned to the Cleveland district office in July, 1907. This brought him into close contact with the fascinating opportunities for market building that lie in the field of co-operation between the central-station company and the local electrical family of any community. He decided four years later to enter utility commercial work and joined the Cleveland Electric Illuminating Company, where he has won for himself a national reputation as one of the foremost utility sales managers of the day.

Editorial Comment

Electrical World, May 12, 1923

Volume 81 Number 19

Rendering Service a Business for Engineers

THROUGH his knowledge and training the engineer is particularly fitted to render service for the public welfare; but, being largely a creature of tradition, he is inclined to be exasperated by incompetence and ignorance and to fail to grasp the significance of facts not related to engineering. He looks upon commercial activities with distaste, not infrequently labeling business a "money-grabbing game." What the engineer fails to realize is that conditions now existing in our industrial civilization require his services, that he is under a heavy obligation to improve the civilization his engineering activities have produced, and that the only possible outlet for such services is through business channels. Engineering activities are really business activities, and the only touch with the public that can be maintained by the engineer is through the business contacts of his engineering operations.

The best salesman is the man who knows his product, and the engineers, therefore, should sell engineering service to the public if they are to develop and become an agency for the improvement of the national life. There is too much loose talking about water powers, transportation facilities, aviation, radio and other engineering subjects by politicians, lawyers, business men, economists and village gossips. If their imaginations are allowed to run wild, such men will hypnotize themselves into believing that their conjectures are facts. This is all wrong. Engineers must become publicists and must bring home the engineering side of these things to the public as business facts. Every engineering argument can be reduced to an economic fact or phrased in a popular manner which can be grasped by the public. If put forth by men who know whereof they speak and who are capable of stating it in a way dictated by business sense and a knowledge of mass psychology, these statements will carry conviction and belief.

Petersen Coil Limited in Its Application

WIDELY different impressions have been left in the minds of engineers who attended the Pittsburgh convention of the American Institute of Electrical Engineers regarding the desirability of the Petersen grounding reactor. Some engineers, and possibly the majority, believe that the Petersen coil is a dead issue and has no application. Others quite as confidently believe that it can be adapted to any transmission system of moderate voltage.

The latter group are evidently impressed with the fact that the Petersen coil installation on the Alabama Power Company's system performed its function satisfactorily in 166 out of 168 cases of operation. While it was brought out in the discussion that the Petersen coil in this installation had to be short-circuited during switching operations to avoid producing severe voltage surges, it was not sufficiently emphasized that a still more practical disadvantage is the necessity of adjusting the reactor for every change in line conditions. If some simple scheme can be developed which will readily and quickly adjust the Petersen coil taps to the capacitance of the line which it is protecting, both these disadvantages will largely be eliminated and its field of application extended. Until that time it appears that the application of the Petersen coil will be limited to moderate-voltage branch lines.

Why Not Centralize Experimentation in Station Design?

IT TAKES courage to be a pioneer in power-station design under existing conditions even though the economic prizes in prospect are unusually attractive. The rapid increase in the demand for power, the size of stations under consideration and the enormous investment required to build a modern station place a premium on conservatism and make reliability the governing element in design. Yet we find many stations under way which incorporate very radical departures in design principles, differ widely in their design details and involve experimentation and untried practice.

This fact is an indication of the courageous and forward-looking thinking prevalent in the central-station industry, which will surely achieve beneficial results. Yet a glance over the designs for contemplated stations shows a startling amount of variation in practice and a great amount of duplication in experimental work. Even though powdered fuel is adopted for many new stations, investigation shows that data for large boiler units are missing and that a great deal of experimentation will be necessary before the new stations operate satisfactorily. Even greater differences in practice and greater dearth of actual data are found in other contemplated practices. For example, one group of engineers enthusiastically plans several stations using reheated steam; another group advocates air preheating and cannot "find" economizers; still another group uses specially designed economizers and condensers and an unusual scheme for heat balancing. On top of all this stations are planned for the use of steam pressures of 375, 550, 1,200 and even 3,000 lb., with steam temperatures ranging up to 900 deg. F. No new basic theory has been developed which would prompt these designs; no great quantity of field data has been obtained, nor has there been any outstanding improvement in equipment recently. The wide adoption of new designs must therefore be largely a psychological reaction to the unprecedented demand for power, the good money market and the healthy state of the industry, coupled with a supreme confidence that the technical problems involved will be conquered.

While this general movement is fundamentally sound

and will prove its value, yet it does seem that there is a good opportunity to achieve the same results in a less expensive and less hazardous way. Why not centralize the equipment and personnel needed to determine experimentally the commercial limits of pressure and temperature and to obtain real data on preheating, economizers, steam reheating, condensers, burning of pulverized fuel and so forth? Would this not seem a logical way to approach an engineering problem of this importance and size? Most of these questions will have to be decided by getting data on installations of magnitude and by doing a great deal of research work, and the centralization plan would be the cheapest way to insure results, to say nothing of eliminating the duplication, false designs and operating hazards that may occur in the individual installations.

Rating of Insulator Should Be Guide to Selection

FROM the user's standpoint the nominal line-voltage method of rating pin-type insulators has always been a source of confusion. One reason is that the ratings, as between different manufacturers, have not been uniform, and, what is more important, no rating of this character can take into consideration all the factors entering into the selection of insulators for any given situation. An insulator of a given nominal line-voltage rating may be good on one extreme for a line voltage of more than its rating. This condition occurs in some sections of the dry desert country of the West. On the other extreme a line operating at the same voltage may demand an insulator, rated on the same basis, at as high as eight or ten times the line voltage. This occurs where salt or chemical fogs or like conditions put a conducting deposit on the insulators. Between these two extremes lie the long list of system and climatic conditions which call for a selection that has little direct relation to the nominal voltage of the transmission line.

As a result of these conditions the more experienced designers have for a number of years been selecting pin-type insulators largely on dry-flashover voltages after careful consideration of the conditions under which the insulators are to be used. The less experienced designers have been placing dependence on the catalog ratings and then paying for the mistakes of selection in operating trouble and expense.

A demand, voiced by a few individual engineers, in addition to the action taken at the Pacific Coast convention of the American Institute of Electrical Engineers at Portland in 1920, was for a complete standard specification for insulators. When the committee came to examine the manufacturing situation, it was apparent that ceramic engineers have not yet had sufficient experience to write a standard specification for high-tension porcelain and that such a specification would be likely to prove a hindrance rather than a help. While the users were struggling with the rating situation, the manufacturers were struggling with a demand for tests and for compliance with specifications that were almost as numerous as the engineers responsible for the selection of insulators. Transmission-line designers were also embarrassed by the lack of specifications recognized as standards and the consequent uncertainty as to just how any two test voltages for different insulators could be compared. Some of the demands for acceptance tests were largely of the freak class, and the general result of the condition was an economic waste that could be obviated if a standard for design and factory testing could be devised. Since the standardization of the entire insulator specifications could not be undertaken, the committee devoted its attention to clearing up the two conditions which seemed the most embarrassing and that, from a practical standpoint, could most easily be met.

At the Pittsburgh meeting last month the committee presented a recommendation for the standardization of ratings on the basis of dry-flashover voltage, at the same time recommending a standard set of both dry and wet flashover tests. Any discussion of the proposed standards should proceed with a knowledge of the past work and should be devoted to determining constructively whether the committee has presented material that will really clear up the two conditions mentioned. On the one hand, will the designer be enabled, with the proposed rating, more intelligently to select the pin-type insulator he needs and, on the other hand, will the manufacturer be able to put his production processes on a more satisfactory basis and devote less energy to meeting half-baked ideas as to the proper tests to which pin-type and also suspension insulators are to be submitted for acceptance? If this can be done, he will receive more time to work out improvements in insulator design and manufacture. Complete standardization will have to be a step-by-step process based on the development of the art and the economics of insulator production.

Non-Fading Light Needed to Preserve Colors

THERE are numberless examples of paintings which have faded beyond all semblance of their pristine selves. Very serious loss of color has taken place in many museum specimens which it was imperative to preserve as nearly as possible in their original state. In an endeavor to combat this deterioration Sir Sydney Harmer of the British Museum has within the last few years conducted a long series of experiments to determine the character of color changes produced by the exposure of pigments to sunlight or other light, the cause of these color changes in so far as it may be ascertainable, and particularly the possible remedies. The experiments were made by exposing pigmented and other objects under plain and tinted glasses with a control series under black glass, the exposure lasting for several years. The screening glasses covered a range from practically light window glass to a strongly absorbing glass similar to what used to be known as Euphos ordinary yellow green, cutting off all the ultra-violet and most of the violet and blue. This last-named glass had decidedly too strong a color to be a satisfactory permanent housing. Years before this same ground had been, for the same good purpose, pretty thoroughly explored by Dr. Russell and Sir William Abney.

The first fact which was clearly established was that, on the whole, fading from the action of light does not ordinarily take place in the absence of oxygen and moisture. This immunity probably does not extend to some of the very fugitive dyes like erythrosine, but the relation is generally true that where there is no oxygen and no water there is no fading. Moreover, as

might be anticipated from our general knowledge of photochemical reactions, the strongest fading effects were produced by direct sunlight, which was at least a score of times more injurious than the strong devised daylight. The control experiments, which freely let through a large part of the heat associated with the illumination, showed plainly that the effect of heat as such was substantially negligible.

Fading due to artificial electric light was much less than even with devised daylight—about one-sixth as much according to the experiments—the electric light used for the comparison being a powerful gas-filled incandescent lamp. Such a lamp is by no means free from ultra-violet radiation; hence there is the probability that a toning screen which would hold down the radiation on objects to something substantially within the limits of the visible spectrum would be of material assistance in still further preventing fading. Indeed, artificial daylight, when not abnormally rich in blue, gives promise of displaying colored objects as in a museum to better advantage in many respects than natural daylight. However, one must remember that while a great deal of photochemical activity has been charged up to the ultra-violet light, pretty nearly every part of the spectrum has under favorable circumstances a chemical effect upon something.

From a practical standpoint it would seem to be worth while to work out a source of non-fading light and then take up wherever possible the additional problem of preserving valuable objects with a still greater probability of success by sealing them from the air. There is probably no such thing as absolute prevention of all fading, but if the danger could be put far off down the centuries by means which now can be easily applied the end would seem well worth the effort.

Modulated High-Frequency Telephony Over Transmission Systems

INTERCOMMUNICATION between substations and other strategic points on a transmission system and its distributing center or generating stations has always been more or less troublesome. In the early days, when transmission lines were short and the energy sent over the lines moderate, it was no difficult matter to string telephone lines as transposed metallic circuits below the power lines and to obtain reasonably good and reliable results. Sufficiently accurate transposition was, however, not always easy, and hearing was somewhat interfered with by the effect of leaks. Moreover, the line ran a risk of contact with the transmission circuits through a break in the latter. None the less, when most circuits were on wooden poles and the duty comparatively light the telephone line got on fairly well.

Today, with very long transmission lines carrying great amounts of energy and strung for the most part on steel poles or towers, the erection and maintenance of a first-class communication system is very far from easy. All sorts of protection have to be used both for the safety of operators and to guard against interruption of communications in case a surge starts on the power line. When everything is in order good results may be obtained over long distances, but abnormal operating conditions will very easily put the line out of service at just the time when it is most needed. In a few instances separate pole lines on the same right-of-way have been used for the telephonic communication, but this is such an outrageously expensive proposition both in first cost and maintenance that it is not likely to become popular.

Recently a good deal of interest has been excited in radio communication, particularly the variety of it somewhat loosely known as "wired wireless." In point of fact this is nothing but telephony by modulated high-frequency currents, which in this case have their locus on the transmission lines to which the oscillations are communicated instead of being in the free ether customarily employed for radio. A good many attempts have been made by central-station companies and others to utilize this particular variety of telephony on a considerable scale. Without wishing to be censorious of a new development just finding its application, considerable is still to be learned and accomplished before it can be adopted as an emergency means of communication with any assurance. It is encouraging, however, to see so many companies willing to do a little pioneering and experimenting in this connection. Out of experiences like those related in this issue and that for April 21 should come knowledge which will enable the manufacturers' development departments to put in installations of greater reliability.

Actual tests reported in the April 21 issue show what in fact might have been anticipated—that the efficiency of the power line as a carrier for extremely high-frequency oscillations depends in very large measure on the electromagnetic properties of the system considered as a high-frequency proposition. It is not surprising, therefore, to learn, first, that the frequencies desirable on the ordinary transmission system for wave telephony are comparatively low, and that there is a marked preference on any given system for certain groups of low frequencies. In one case which was well investigated the shortest wave length by which transmission was well effected was about 2,000 meters, with another useful range at say three times this wave length, and still another at about 18,000 meters. Near these points transmission was good, away from them bad and sometimes entirely ineffective. This may mean that there are resonant frequencies on the system which virtually form short circuits for oscillations of most wave lengths, or that impedances of equally bad effect may turn up.

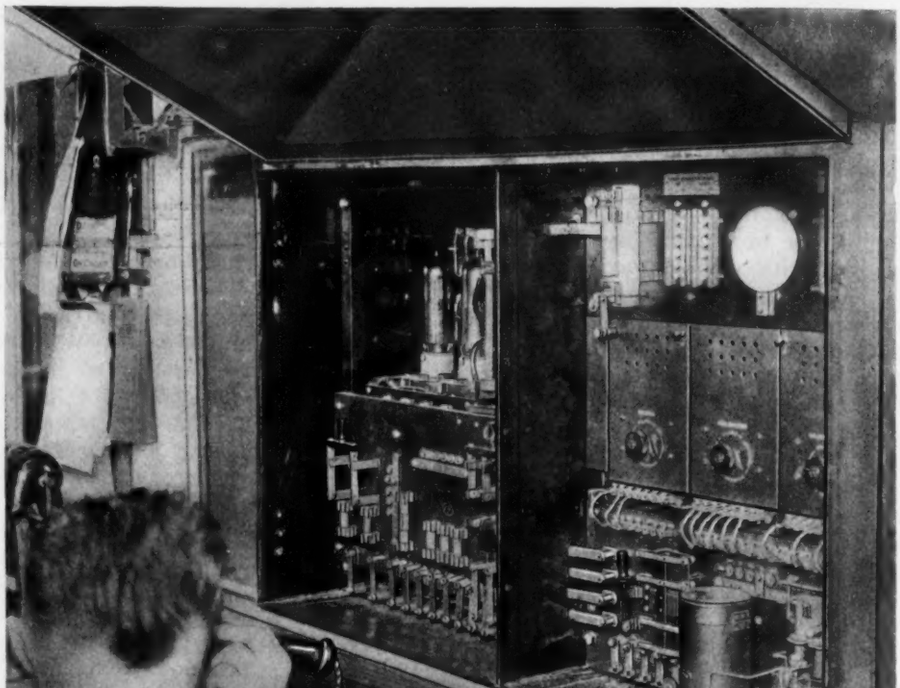
As might be expected, the scheme is interfered with by surges, short circuits and even the effect of switching. In fact, it should be easily seen that anything of this kind is likely greatly to upset the balance of the high-frequency system. Further trouble has been encountered from "spitting" insulators, which, of course, means variable leakage with all that that implies, and similarly electrolytic lightning arresters are likely to upset the successful operation of the system.

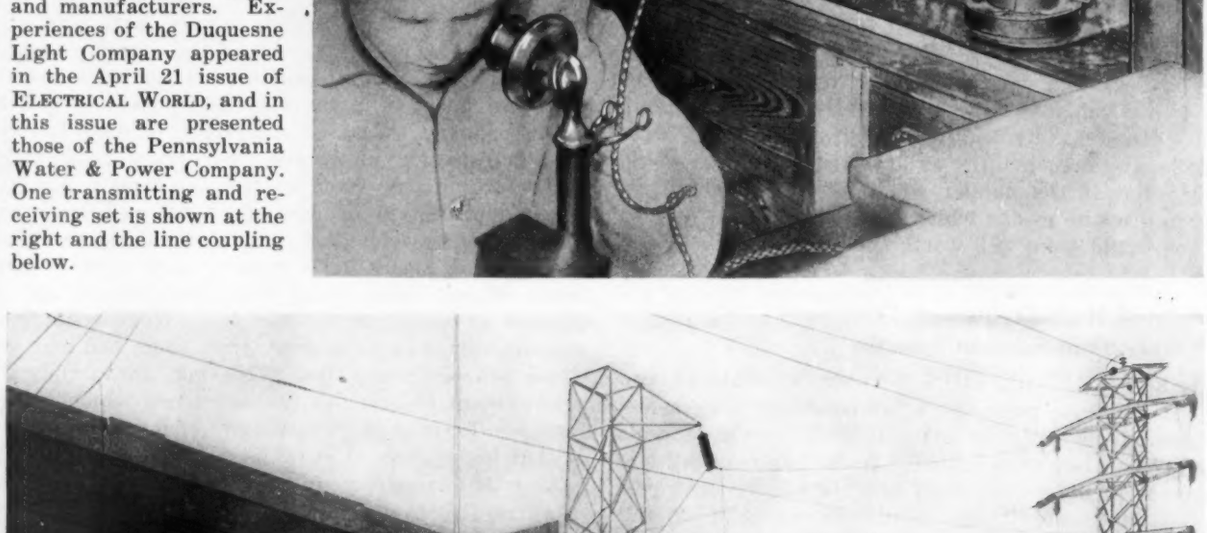
Doubtless, one factor in the successful operation of the Baltimore-Holtwood system, reported in this issue, is the simplicity of the transmission lines—that is, a single line without taps. This is in somewhat sharp contrast to the complicated system of the Duquesne Light Company, whose experiences were recorded in the April 21 issue.

It remains to be seen how far "wired wireless" can be used in a general way, although at present it may surely be said to be promising. Beyond all this comes the ordinary wave telephony, which has troubles of its own and plenty of them, but which may still "make good" over ordinary transmission system distances. It also seems likely that recent improvements may help the situation very materially so far as ordinary radio is concerned.

Load Dispatching by Wired Wireless

IN ANY new development or application it is nothing unusual for various obstacles to arise. To a limited extent this has occurred with the application of carrier-current telephony to load dispatching and interstation communication. Remarkable strides have been made already by manufacturers in ironing out the obstacles, but further progress will be made in proportion as the operating companies exchange experiences with their fellow companies and manufacturers. Experiences of the Duquesne Light Company appeared in the April 21 issue of ELECTRICAL WORLD, and in this issue are presented those of the Pennsylvania Water & Power Company. One transmitting and receiving set is shown at the right and the line coupling below.





Baltimore-Holtwood Carrier Current Giving Excellent Service

Tested Under Service Conditions to Determine the Effect of Grounding Lines, Severity of Ground Currents, Charging Lightning Arresters, Nature of Coupling, Etc.—Three Months' Operation Entirely Successful

SEEKING some reliable means of assuring telephone communication between its Holtwood (Pa.) generating station and its main distributing substation at Baltimore,* the Pennsylvania Water & Power Company has installed and tested a carrier-current telephone outfit. It has been in operation since the beginning of the year and, according to tests and the experience of the operators, it is entirely successful—so much so that similar facilities for communication are contemplated between the generating station and the Lancaster (Pa.) substation.

In the past telephone communication between these points has been conducted solely over two physical wire circuits consisting of No. 9 B. & S. copper wires supported on wooden poles midway between the two tower lines connecting these points. These physical telephone circuits have provided good service except in cases of ground current and lightning surges. The need of supplementing these circuits by some other means of communication was emphasized, however, on July 25, 1921, when wire communication between Holtwood and Baltimore was totally interrupted for more than seven minutes owing to the failure of the telephone circuits. Prompted by this occurrence, General Electric carrier-current equipment was installed, using the high-voltage circuit as a guiding medium for transmission of speech. Tests were conducted to compare the operation and reliability of the carrier-current equipment with the physical-circuit telephones under service conditions involving grounds on the circuits at various points, ground current between stations, charging of lightning arresters and different degrees of carrier-current coupling.

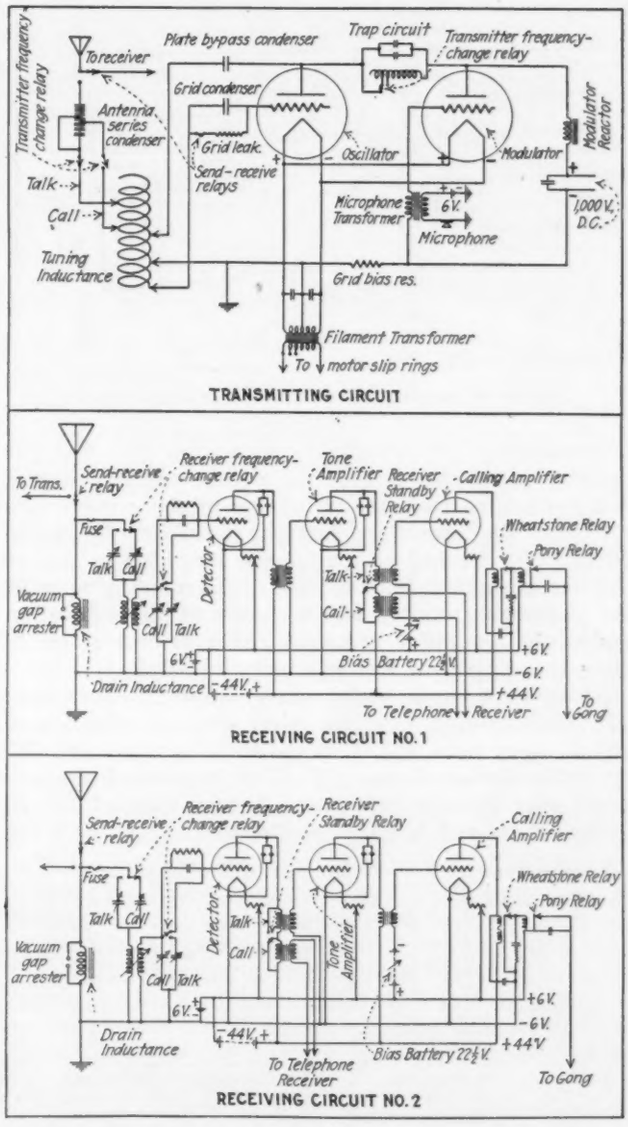
NATURE OF EQUIPMENT USED

The carrier-current equipment installed provides for calling and talking, but transmission of speech or call signals can be carried on in one direction only at a time. A carrier current provides means of transmitting speech and call signals, the calling and talking carrier frequencies being approximately 16,000 cycles and 12,000 cycles respectively

Modulation is accomplished by means of the well-known constant-current system. The calling and talking frequencies are separated by a frequency-change relay operated by a key on the telephone stand. This relay selects the taps on the tuning inductance, antenna series condenser and trap circuit corresponding to the talking or calling frequencies. Power for operating the small motor-generator set is received from the control battery at the station, and energy for lighting the filaments of the tubes is obtained from slip rings on the motor at 154 volts, 30 cycles, and is transformed to 10 volts, 6.5 amp. for the filaments.

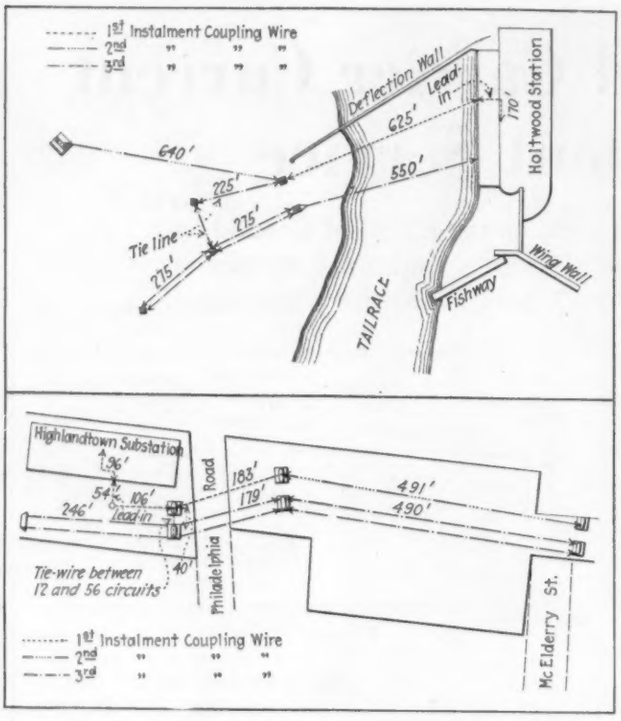
As in the transmitting set, relays are employed to tune the receiving set to the talking or calling frequencies, being operated by raising or lowering the telephone switch hook. The last tube is connected to a calling relay which operates a pony relay to ring a call bell. These call relays are disconnected from the circuit when the receiver is taken from the hook, and at the same time the receiver is automatically connected in the circuit.

Coupling of the transmitting and receiving sets with the transmission line is accomplished by utilizing the



TRANSMITTING-SET CIRCUITS AND TWO RECEIVING CIRCUITS WHICH WERE TRIED

*Approximately 40 miles between stations.



LINE COUPLINGS AT HOLTWOOD AND HIGHLANDTOWN TERMINALS

existing ground wires over the circuit, sections thereof being insulated from the remainder of the ground wire and from the towers and brought to the sets by lead-in wires. The method of coupling is indicated in two of the accompanying illustrations. The coupling wire at the generating station and the wire at the substation end of the line differ in length and have been added to since the equipment was originally installed.

Tests were made under three different conditions: (1) With original coupling wires over circuits Nos. 1 and 2; these were 290 ft. at the Baltimore end and 625 ft. at the Holtwood end. (2) With lengthened coupling wires over circuits Nos. 1 and 2, consisting of 780 ft. at Baltimore and 1,265 ft. at Holtwood. (3) With the coupling wires of condition No. 2 in parallel with coupling wires over circuits Nos. 5 and 6.

The lead-in at Holtwood is 170 ft. in length and that at Baltimore is 150 ft. At Baltimore there are two ground wires on circuits Nos. 5 and 6, both of which are used as coupling wires, while at Holtwood the tail-race span now used as a coupling wire consists of a single wire. The wires are tied together between towers so that an H-shaped coupling is formed. The coupling wires consist of seven-strand $\frac{3}{8}$-in. steel cable.

Using the coupling wires as originally installed over circuits Nos. 1 and 2 (condition No. 1), the transmitters and receivers at Holtwood and Baltimore were adjusted to the best conditions for operation. Receiving condition No. 3 was used both at Holtwood and Baltimore. The quality of the speech was excellent. However, two limitations to the use of the short coupling wire became evident: (1) The talk and call frequencies could not be separated far enough to prevent the talk frequency from ringing the call bell, and (2) the frequency of the carrier could not be lowered to a value which would prevent interference from commercial long-wave radio stations.

Using the same coupling, a series of grounding tests were conducted on circuits Nos. 1 and 2. The procedure followed was to take the circuits out of service and ground a number of phases at Holtwood or Baltimore, or at both stations as desired, and to attempt conversation and ringing over the carrier.

The results from this test show that under the conditions employed, communication was impossible in either direction with circuits Nos. 1 and 2 grounded at both Holtwood and Baltimore. However, with one phase ungrounded entirely and the other five conductors grounded at both ends communication became possible. With one circuit ungrounded at both ends and the other circuit still grounded at both ends talking and calling became entirely normal.

COUPLING INCREASED

As a result of the difficulties previously mentioned, the coupling over circuits Nos. 1 and 2 was lengthened both at Holtwood and Baltimore. This necessitated a retuning of both sets to allow for the increased capacity

RESULTS OF GROUNDING TESTS ON CARRIER-CURRENT COMMUNICATION—CONDITION NO. 1—ORIGINAL COUPLING WIRE ON CIRCUITS NOS. 1 AND 2

Length at Highlandtown, 290 ft.
Length at Holtwood, 625 ft.
(Hn. = Highlandtown. Hd. = Holtwood.)

Test No.	Location of Grounds	Result	Remarks
1	Hd. — Hn.	Hd. could not hear Hn. talk. Hn. could not hear Hd. except for one short interval —very faintly then. Could not call either direction.	Five and six circuits carrying load.
2	Hd. — Hn.	Hd. could hear clearly but faintly. Hn. could hear faintly, but speech not understandable. Speech made understandable by changing receiver coupling.	Five and six circuits carrying load.
3	Hd. — Hn.	Hd. could hear at two-thirds normal intensity. Hn.—Not noted.	Five and six circuits carrying load.
4	Hd. — Hn.	Could call in both directions. Conversation about normal strength.	Five and six circuits carrying load.
5	Hd. — Hn.	Conversation approximately one-half normal at Hn., two-thirds normal at Hd. Could not ring either direction without adjusting Wheatstone relay.	Five and six circuits carrying load.
	Note	Code heard on call settings.	

CONDITION NO. 2—LENGTHENED COUPLING WIRE ON CIRCUITS NOS. 1 AND 2

Length at Highlandtown, 780 ft.
Length at Holtwood, 1,265 ft.
(Hn. = Highlandtown. Hd. = Holtwood.)

Test No.	Location of Grounds	Results	Remarks
9	No. 1 Hd. Hn. No. 2 Hd. Hn.	Hd. could not ring Hn. Hn. could ring Hd. Speech faint from Hd. to Hn. and Hn. to Hd. Reception slightly better at Hd. Conversation could be understood.	Nos. 5 and 6 carrying load.
10	No. 1 Hd. Hn. No. 2 Hd. Hn.	Calling satisfactory both ways. Reception of speech at Hn. one-half normal strength. Reception of speech at Hd. normal intensity but blurred. Quite understandable.	Nos. 5 and 6 carrying load.
11	No. 1 Hd. Hn. No. 2 Hd. Hn.	Hd. could not ring Hn. Hn. could ring Hd. 80 per cent signal reception at Hn. 66 per cent signal reception at Hd., but understandable. Tried retuning to get call. Calling should be received by adding capacity or decreasing play on Wheatstone relay at Hn.	Nos. 5 and 6 carrying load.
12	No. 1 Hd. Hn. No. 2 Hd. Hn.	Hd. could not call Hn. Hn. could call Hd. Signal reception 80 per cent at Hd. Signal reception 90 per cent at Hn. Best quality of speech yet obtained.	Nos. 5 and 6 carrying load.
13	No. 1 Hd. Hn. No. 2 Hd. Hn.	Voice two-thirds normal both ways. Hn. could call Hd. Hd. could not call Hn.	Nos. 5 and 6 carrying load.
14	No. 1 Hd. Hn. No. 2 Hd. Hn.	Calling impossible in both directions. Hd. could not hear Hn. Hn. heard Hd. very faintly. Not understandable.	Nos. 5 and 6 carrying load.
15	No. 1 Hd. Hn. No. 2 Hd. Hn.	Calling impossible both directions. Hn. heard Hd. very poorly—mushy, not understandable. Hd. heard Hn. very faintly—not understandable. Time not available for retuning properly.	Nos. 5 and 6 carrying load.
16	No. 1 Hd. Hn. No. 2 Hd. Hn. Jarrettsville	Talking and ringing impossible both ways.	Nos. 5 and 6 carrying load.
17	No. 1 Hd. Hn. No. 2 Hd. Hn. Jarrettsville	Hd. could ring Hn., but Hn. could not ring Hd. Hd. cannot hear Hn. talk. Hn. can hear but cannot understand Hd. Voice very weak.	Nos. 5 and 6 carrying load
18	No. 1 Hd. Hn. No. 2 Hd. Hn. Jarrettsville	Could call both ways. Hn. speech reception, 85 per cent. Almost normal reception at Hd. A little blurred at times.	Nos. 5 and 6 carrying load.

and inductance due to the additional wire. Receiving connection No. 3 was still used at both stations. With circuits Nos. 1 and 2 carrying load under normal conditions, reception was very loud and clear. The quality of speech, however, was not so good as with the shorter coupling wire, since the signal strength was increased beyond the limit of some of the apparatus. Furthermore, the 25-cycle hum was increased somewhat, as would be expected. With the longer coupling it was found possible to separate the call and talk frequencies so that there was no interference between the two, and in addition code interference was avoided. Frequency measurements with a wave meter at Baltimore determined the call frequency as 16,200 cycles and the talk frequency as 12,400 cycles (wave lengths, 18,500 m. and 24,200 m. respectively).

Compare Line and Carrier Telephone

In an attempt to reproduce the conditions which caused total interruption of the physical telephone circuit on July 25, 1921, eight ground current tests were made and the behavior of the carrier-current equipment was carefully observed and compared with that of the physical lines. No. 1 generator and No. 1 transformer at Holtwood, with the transformer neutral grounded and the ground stack shunted, were connected to circuit No. 2. Phases B and C of this circuit were short-circuited and grounded at Baltimore, and phase A was left open. A separate exciter was used to control the generator voltage. Circuits Nos. 1, 5 and 6 were kept in service and carrying load.

The results of the tests with these conditions are arranged in condensed form in the accompanying table. With the neutral of the telephone-phantom transformers grounded at Holtwood and Baltimore, furnishing a metallic return for ground currents, the physical lines became useless as soon as the ground current reached an appreciable value. The arresters flashed over at both ends of the line, causing very loud clicking in the telephones, which continued until the fuses blew at Baltimore. The carrier equipment was less seriously affected. The chief disturbance seemed to come from the periodic flashing over of the physical-line arresters, causing a clicking in the carrier receiver. This clicking ceased as soon as the fuses blew on the physical lines. Switching conversation could be carried on successfully in spite of the noise.

With the "disconnects" opened on the telephone lines and the lines short-circuited and grounded at both ends, little or no noise could be noticed in the receiver of the carrier equipment. This indicates that the noise in the carrier was largely due to interference from protective apparatus on the telephone lines.

The most serious trouble occurred when the phantom neutral at Baltimore was opened while that at Holtwood remained grounded. The carrier actually became so noisy that communication was impossible for about twenty or thirty seconds. However, this was due to the same cause. The noise ceased after arresters had failed and fuses at Baltimore had functioned.

Two ringing tests were made. Holtwood called Baltimore successfully, but when Baltimore attempted to call

Holtwood the Holtwood bell rang continuously. The test was repeated with both equipments in position to receive calls (that is, receivers on the hooks), and while there was no effect at Baltimore, the Holtwood bell rang intermittently.

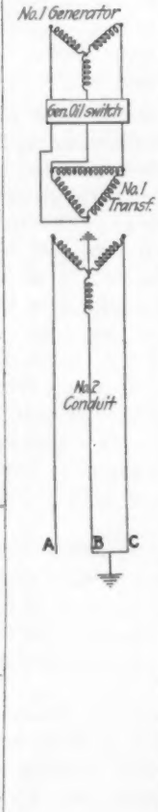
A second series of grounding tests, more comprehensive than those made under condition No. 1, were made with the longer coupling over circuits Nos. 1 and 2. In certain of these tests grounds were made between terminals of the transmission lines as well as at the ends.

As in the previous grounding tests, satisfactory communication could not be obtained with circuits Nos. 1 and 2 grounded at both ends. Baltimore could consistently hear Holtwood, but the speech was too faint to be understandable. The test is of significance in showing that the longer coupling wire at Holtwood was a better transmitter than the shorter wire at Baltimore. With five phases grounded at both ends and one phase open throughout, talking was about two-thirds of normal strength in both directions. Ringing was possible in one direction only, but this was shown to be due to a slight misadjustment in tuning at Baltimore, since it was found that, after retuning, calls could be received in both directions satisfactorily. This test, together with a similar test made with the short coupling, pointed out the desirability of adding coupling wires over circuits Nos. 5 and 6 in addition to those over

COMPARISON OF WIRE AND CARRIER COMMUNICATION DURING GROUND CURRENT TESTS—LENGTHENED COUPLING WIRE CONDITION NO. 2 ON CIRCUITS NOS. 1 AND 2

Length at Highlandtown, 780 ft.
Length at Holtwood, 1,265 ft.

(Hn. = Highlandtown. Hd. = Holtwood.)

Test No.	Test Connections Used	Current Readings, Final Built-up Value: Ground Amp.	No. 2 Circuit Amp.: BΦ	No. 2 Circuit Amp.: CΦ	Generator Field, Amp.	Method of Applying Short Circuit	Connection of A. & C. Telephone Lines	Method of Observations: Carrier	Method of Observations: Physical	Effect of Short-Circuit on Physical Lines	Effect of Short-Circuit on Carrier
1	Hd. No. 1 Generator	0	70	70			Phantom—neutral grounded at Hd. and Hn.	Hd. talked continuously to Hn.	Hn. talked continuously over "A" line.	Hn. at maximum current continuous hum. Lines just usable and conversation could be carried on. Hd., no report.	Snap heard when generator switch was closed. Carrier intensity reduced slightly owing to grounds on B and C phases. No. 2 circuit.
2		130	80	100	120	Built-up short held for half minute at normal generator load. Generator oil switch opened manually and immediately closed for another half-minute interval.	Phantom—neutral grounded at Hd. and Hn.	Hd. talked continuously to Hn.	Hn. talked continuously over "A" line.	Hn., both lines failed during sudden short. One fuse blew on "A" line. Two fuses blew on "C" line. Carbon vacuum arresters failed on both lines. Hd., phantom transformer heated and threw out compound.	Clicking in telephone of about same intensity as speech and frequency of approximately 5 cycles. Hd. could be understood.
3		125	70	85	130		Phantom—neutral grounded at Hd. and Hn.	Switching conversations carried on.	Hn. talked continuously over "A" line.	Hn., both lines failed during sudden short. Both fuses blew on both lines. Carbon vacuum arresters failed on both lines. Hd. arresters arced over, but nothing was damaged.	If unfamiliar conversation had been carried on, it probably could not have been repeated owing to clicking in receiver similar to previous test.
4		130	75	90	130		"Disconnects" opened. Lines short-circuited and grounded at Hd. and Hn.	Switching conversations carried on.			Little noise noticed. No clicking noticed.
5		130	80	100	130	Full-load armature current thrown on suddenly and left on half minute. Short repeated immediately.	"Disconnects" opened. Lines short-circuited and grounded at Hd. and Hn.	Switching conversations carried on.			Test to determine if clicking was audible. Slight click heard when generator oil switch was closed. Carrier not noisy.
6		120	70	80	120	See Tests Nos. 1, 2, 3 and 4.	In service, neutral open at Hn., neutral grounded at Hd.	Switching conversations carried on.	Hn. talked continuously over "A" line.	Hn., both lines failed during period of built-up short. Both fuses on both lines failed. Both carbon vacuum arresters failed. Hd., arresters flashed, but nothing was damaged.	Conversation became impossible when generator current ammeter read 200 amp. Remained too noisy for conversation until generator current reached 500 amp., when fuses probably blew on physical lines.
7		.....	.....	.....	.....	See Tests Nos. 1, 2, 3 and 4.	See Test No. 1.	Ringing tried both direct.	No observations.	Hn., both lines failed, both fuses blew on both lines. Carbon vacuum arresters failed on both lines. Hd., vacuum gap arresters failed.	Hn. received rings satisfactorily, but Hd. bell rang continuously when receiver was on hook.
8	Circuits Nos. 1, 5 and 6 in service.	.....	.....	.....	.....	One built-up short and two successive sudden shorts for half-minute periods.	See Test No. 1.	Both sets in position to receive call. Receivers on hooks.	No observations.	Hn., "C" line failed second short. "A" line failed third short. One fuse blew on "A" line. Carbon vacuum arresters on both lines failed. Hd., no damage.	Hd. bell rang intermittently. Hn. bell did not ring.

No ground current. Ground switch accidentally left open at Hd.
NOTE:—Telephone bells rang until physical lines failed.

circuits Nos. 1 and 2, so as further to insure there being always one clear phase in the event of trouble on the circuits. Accordingly, coupling wires were added over circuits Nos. 5 and 6 at Holtwood and Baltimore and tied in with the coupling wires over circuits Nos. 1 and 2, forming an H-shaped coupling wire.

After the addition of coupling wires over circuits Nos. 5 and 6, the set was again retuned. The output to the coupling wire at Baltimore was then 0.35 amp. at the talking frequency and 0.36 amp. at the calling frequency. The output at Holtwood after retuning was 0.29 amp. on the talking frequency and 0.25 amp. on the calling frequency. With the new adjustment the speech was very loud but not modulated quite so well as in the two previous conditions. The voice had to be pitched to a low tone or speech was unintelligible. Furthermore, the 25-cycle hum was very loud. An attempt was made to lower the speech intensity to a comfortable value by introducing a resistance in series with the high-voltage generator field, thus lowering the plate voltage. This cleared up the speech to some extent, but interfered with calling. Consequently the receiving-set connections were changed to connection No. 2 in the accompanying diagram. This made some improvement in modulation of speech and practically eliminated the 25-cycle hum. Calling was satisfactory.

Only one grounding test was completed with this connection. All phases of circuits Nos. 1 and 2 were grounded at Holtwood and Baltimore. There seemed to be no noticeable difference in transmission, talking and calling being normal in both directions.

With the receiving connections just named, a test was made to determine the effect of lowering the input voltage to the motor-generator set. It was found that conversation could be carried on with a voltage as low as 140, while calling required a minimum of 180 volts input to the motor.

Effect of Arrester Charging

For the purpose of observing the operation of the carrier equipment during arrester charging, a series of tests were conducted during the regular daily charging period in order to obtain actual operating conditions. Each arrester at both Holtwood and Baltimore (circuit No. 2 arrester at Baltimore out of service) was charged in the normal manner. Observations consisted of talking and listening at both stations, thus enabling each station to compare the intensity of the disturbance caused by the local arresters with that from the arresters at the other end of the transmission system. In addition, the effect of arrester charging on the call bell was noted at each end.

While the arrester gaps were closed, no disturbing noises were noticed, but a loud static discharge was heard each time an arrester gap was opened or closed. The intensity of this discharge was about twice as great at the station at which the arrester was charging as it was at the other station. Throughout the test speech could be understood satisfactorily at both Holtwood and Baltimore on account of the short duration of the discharge. However, if the discharge had continued an appreciable time, reception would have been practically impossible at the station at which the arrester was charging.

Charging of arresters at either Holtwood or Baltimore did not affect the Holtwood equipment with both receivers on the hooks in position to receive calls. At Baltimore, however, during charging at either station the bell gave short clicks each time an arrester gap was opened or closed.

A number of tests similar to those conducted on the carrier equipment were made on the physical lines during arrester charging. As before, observations consisted of talking and listening at both ends. The results obtained showed that there were no disturbing noises when the gaps were actually closed, but when the operator opened or closed the gaps a faint static discharge followed by a louder click was heard in the receiver. The intensity of this discharge was at all times much less than that heard over the carrier.

Observations made on the carrier equipment during sleet runs on the transmission systems—that is, a practice adopted during sleet storms to melt the sleet from the wires by circulating sufficient current through them to melt the sleet—showed that these runs in no way affected communication. Conversation was carried on with each of the four circuits on a sleet run. The physical circuits were also not affected during sleet runs.

Radiation Negligible

Little or no radiation is to be expected from the carrier wave because of the low frequency employed and the close coupling with the circuits. On one occasion, however, it was reported at Holtwood that conversation had been overheard from the Holtwood station by a Westinghouse "type RC" receiving set in the clubhouse. This occurred during the period of adjustment with the original coupling wire. Since then no report of any reception of this character has been received. An attempt was made later to repeat the above experience with the present adjustments, but no conversation could be picked up. An attempt was also made to pick up signals using a number of single-circuit amateur receiving sets installed near circuits Nos. 3 and 4 at Holtwood, but no reception was reported. However, in no case were the sets tuned to the wave length of the carrier, their range being limited to the broadcasting wave lengths.

Carrier Current Meets Operating Requirements

As a result of these tests it was concluded that conversation and calling can be conducted in an entirely satisfactory manner over the carrier equipment for all conditions met in normal operation. With coupling on circuits Nos. 1, 2, 5 and 6 communication is practically unaffected by grounding circuits Nos. 1 and 2 at both ends. Previous tests (those made with one coupling wire over circuits Nos. 1 and 2) indicate that when using the present coupling wire over all four circuits conversation would be satisfactory with but one phase of the four circuits free from grounds. Conversation can be carried on with the carrier under conditions which render the physical lines totally inoperative as demonstrated by the ground-current tests.

No final conclusions can be drawn at this time as to the comparative operation under all conditions of the carrier equipment and the physical lines, because of the short time the former has been in service. Further observations will be made during heavy static and at times of electrical storms. A careful check is being made of day-to-day operation to determine the effect of variation in weather conditions.

The foregoing information is based on tests made by J. E. Allen, chief of tests for the Pennsylvania Water & Power Company.

Lead Resistance for Current Transformers*

Advocates at Least 0.1 Ohm of Non-Reactive Resistance in Leads of All Current Transformers Subject to Precision Tests

BY F. B. SILSBEE
Physicist, Bureau of Standards, Washington, D. C.

FROM the time of the first introduction of current transformers the doctrine which has been preached continually by professors, engineers, manufacturers and every one else has been "keep the secondary burden small if you want to obtain accuracy." Like any other good thing, this idea can be carried too far; hence this plea from the testing laboratory for "moderation in all things."

In the precise testing of a current transformer the methods used in any laboratory require the insertion into the secondary circuit of a certain amount of impedance. In the use of the comparison methods, where one transformer is compared with a standard, this impedance can be fairly small (0.02 ohm), and can often be neglected. In the more precise "absolute" methods which test a single transformer, however, the impedance is necessarily large and is often from 0.1 ohm to 0.2 ohm.

PROBLEMS IN PRECISION TESTING

If the user of the transformers requests a test with a burden consisting of, say, an ammeter, wattmeter and 0.1 ohm in leads, then all is well; for it is very easy for the laboratory to connect the instruments in the circuit with short, heavy leads and substitute the testing circuit in place of the 0.1-ohm leads. Even if the burden is specified as an instrument having 1 millihenry and 0.4 ohm with 0.01 ohm leads, the laboratory can still "beat the game" by substituting an inductor having the desired 1 millihenry and only 0.2 ohm, thus gaining a margin of 0.21 ohm for the testing circuit. This is not perfectly satisfactory, however, since (1) the impedance of the actual instruments may vary slightly from the values stated (which are usually obtained from the manufacturer as representative of the type), (2) the reactance of the instruments often changes somewhat from one point of the scale to another, and (3) if the magnetic circuit of the instrument contains iron, the reactance will vary with the current and hence the air-core coil of fixed value is not equivalent to the actual instrument.

The rub comes, however, when the user requests a burden of which the time constant (ratio of inductance to resistance) is greater than the value (0.005 second) which can be obtained with air-core coils of moderate size or in which the total resistance of the burden is less than 0.1 ohm. "One watt-hour meter with 3 ft. of No. 10 B. & S. gage (i.e., 0.003-ohm) leads" is a typical example of such a burden.

What can the laboratory do in such a case? It is theoretically possible to test a current transformer with zero burden, but to adapt the apparatus for such a method is very impracticable. Actually in such a case the laboratory now does double work. It first makes a test with the least resistance it can use—i.e., with a burden of "one watt-hour meter plus 0.10 ohm." It then repeats the test, using "one watt-hour meter plus 0.197 ohm." If the ratio and phase angle vary linearly with resistance in the secondary (which is roughly true), then an extrapolation gives the desired data.

The purpose of this article is to suggest that instead of doing this, the customer should always include a non-reactive resistance as great as 0.1 ohm, with transformers which are likely to be submitted for precise test.

A consideration of the objections that can be offered to the adoption of such a practice in various cases follows:

Current transformers submitted for laboratory tests may be classified according to the purpose for which they are used, thus:

A. *For special measurements of the highest precision.*—Here the transformer is always first tested with the actual burden with which it is to be used and the necessary corrections to its ratio and phase angle are applied in working up the results of the measurements made with it.

B. *For general use under conditions which cannot be foretold, but which may require high precision.*—Here the test is made with the burden which will most probably be used later and the corrections are often but not always applied in the actual use of the transformer later.

C. *For work of less precision.*—Here a test is needed to make sure that the performance does not depart excessively from the theoretical. Only the nominal value of the ratio is used in the future use of such transformers.

D. *For a type test.*—Here the test is desired to indicate the relative merit of the particular type of transformer relative to other types. The results of the test will probably not be utilized in actual measurements made with the transformer later.

Besides these four classes, there are the great body of transformers which have never been and never will be subjected to laboratory test and which need not be considered.

For transformers of class D there is obviously no objection to the insertion of an additional 0.1 ohm in the burden in all cases, since the comparison of types is not affected thereby. For class A also the presence of the 0.1 ohm will not increase the labor of observation or computation, except for the purely physical labor of seeing that the 0.1-ohm coil is correctly inserted. Any such difficulty is more than offset by the fact that, when desired, the transformer can be used with the same correction table when 50 ft. away from the instruments if connected to them by No. 10 wire.

In cases B and C, however, the question arises whether or not the insertion of the 0.1 ohm increases the ratio and phase-angle errors of the transformer. Such an increase in error might appear either as a greater departure from the ideal, nominal ratio and zero-phase angle or as an increase in the variation in ratio and phase on passing from one value of current or burden to another value of current or burden. An examination of the magnitude of such effects is next in order.

ERRORS NOT PROPORTIONAL TO BURDEN

It is very natural, though erroneous, to consider that the errors in a current transformer are, at any rate roughly, proportional to the external secondary burden and that if one reduces his burden from 0.15 ohm to 0.05 ohm by eliminating lead resistance, he will cut his errors to one-third. The fallacy of this appears when one considers that the secondary winding has a resistance of several tenths of an ohm, to say nothing of its leakage reactance. The secondary resistance of an assortment of twenty-five current transformers selected at random varied from 0.158 ohm to 0.55 ohm, the average being 0.35 ohm.

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The reduction of the burden from 0.15 ohm to 0.05 ohm, therefore, on the average reduces the total resistance from 0.50 to 0.40 and probably reduces the errors to 80 per cent of their former value instead of dividing them by 3.

Actual data on a number of transformers tested at the Bureau of Standards during the past few years show that the change in ratio when 0.1 ohm is inserted in the secondary was in the worst case only 0.1 per cent at 5 amp. and 0.2 per cent at 0.5 amp. In most other cases, however, the changes were decidedly less and seldom exceeded 0.02 per cent. The same poor transformer showed a phase-angle change of 25 minutes when 0.1 ohm was added, but no other showed more than 2 minutes at full current or 6 minutes at 0.5 amp.

It appears from this that the errors introduced by using the nominal instead of the actual ratio of the transformer are only very slightly greater when a lead resistance of 0.1 ohm is used. Furthermore, fully 50 per cent (an actual count of transformers tested at the bureau showed 66 per cent) of transformers have ratios less than nominal, so that the chances are about even that the ratio of a given transformer will be improved rather than impaired by the insertion of resistance.

Similar data show that the changes in ratio and phase angle with current at a given frequency and burden are only very slightly affected by the addition of 0.1 ohm. The increase in the change in ratio is only a few parts in 10,000, and the increase in the change in phase angle is only a few minutes in most of the transformers.

The conclusion is thus reached that the practice of allowing at least 0.1 ohm of non-reactive resistance in the burdens of all current transformers which are likely to be submitted to precise tests is at once highly desirable in the testing and perfectly harmless in the use of the transformer.

Co-ordinating Steam and Hydro Operation

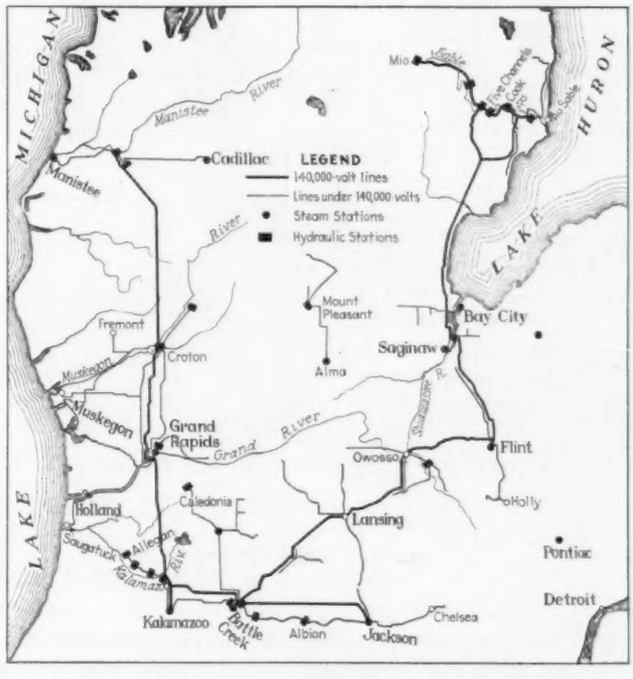
Entire System Economy More Important than Individual Plant Economy—Must Keep Pace with Weather Conditions—Problem Is When to Use Steam and When to Use Hydro Equipment

By F. W. POLLOCK
Consumers' Power Company, Jackson, Mich.

OWING to the necessity of shifting loads on interconnected hydro-electric and steam plants in order to keep pace with weather conditions, to protect against line breakages and to improve power factor or voltage regulation, it is not always economical to operate stations at their highest individual efficiencies. If proper consideration be given to *system* economy, however, it may sometimes even pay to sacrifice individual plant economy.

The Consumers' system might be visualized in the shape of an enormous "U," formed by the 140-kv. transmission lines which convey energy from the Au Sable River on one side and the Manistee River on the other side of the state down to Battle Creek, which is the center of southern distribution. The principal sources of hydro-electric energy are at the extreme northern ends of the "U," while the large distribution centers are at the southern intersections of the two lines. This "U" is somewhat distorted as the transmission line connects with steam generating stations at Grand Rapids, Kalamazoo, Jackson, Flint, Saginaw and Bay City. Moreover, other hydraulic stations are connected by 40-kv., 70-kv. and 22-kv. transmission lines, which, along with the lower voltage circuits, complete the network for serving the people of Michigan.

The maintaining of frequency and correct voltage, the question of power factor and the protection of service at different points are problems which become more complicated with long stretches of high-voltage transmission lines. Because of the fact that this system is a hydro-electric system and consequently somewhat dependent upon the ever-changing weather conditions, changes in methods of operation are often necessary over night. The yearly cycle of operation for the system is divided into four periods which follow the four seasons of the calendar year. This is indicated on the chart showing comparison of rainfall with hydraulic



THE "U" TRANSMISSION LINES OF THE CONSUMERS' POWER COMPANY

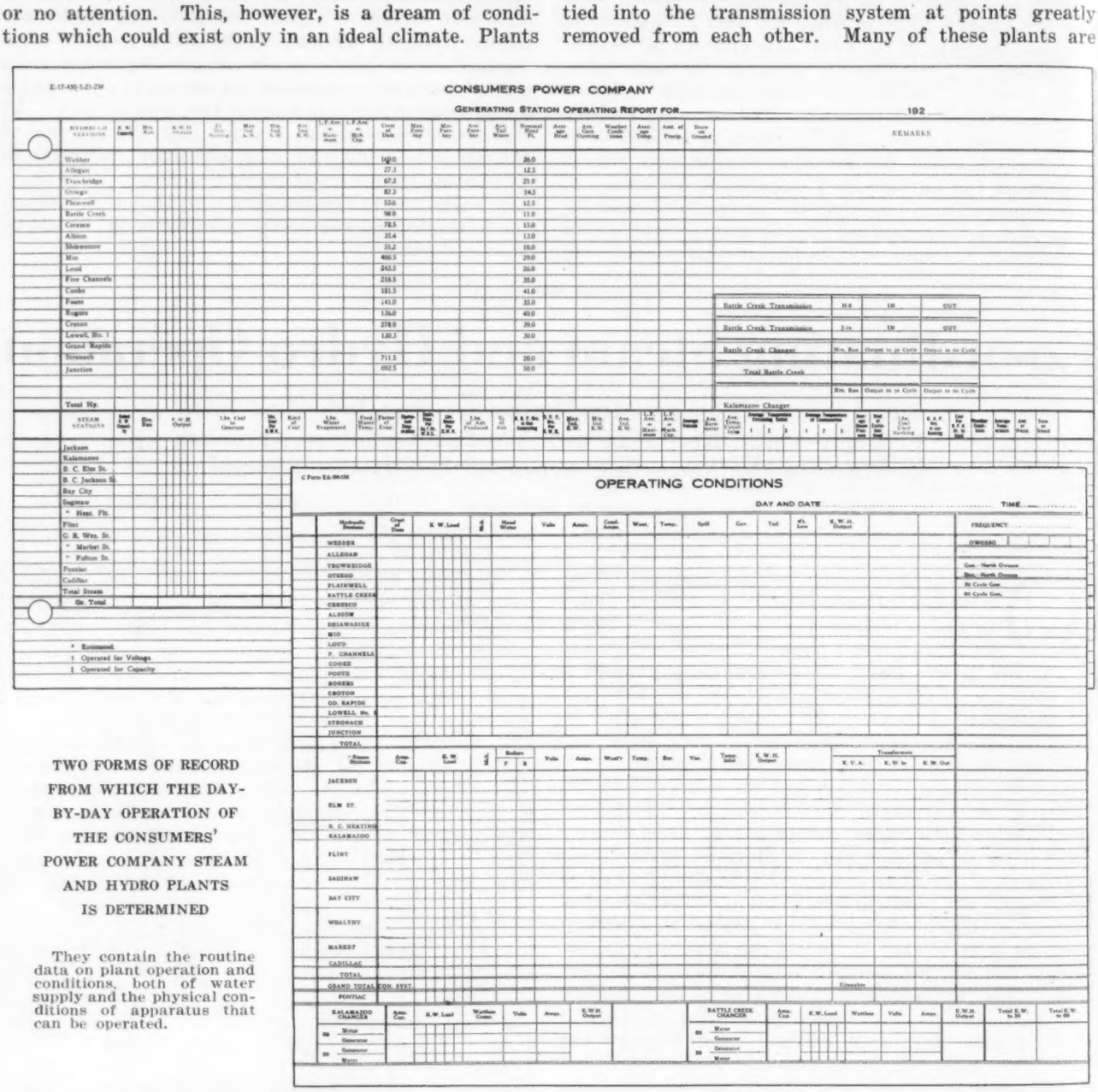
output. With the spring comes the break-up of the winter ice and snow, which, with the customary rains, results in a high-water period. Summer brings the hot, dry weather accompanied by drought, resulting in the low-water period of the system. The fall rains somewhat relieve the conditions of the summer, giving better water conditions. This allows the steam equipment of the system a breathing spell before the cold weather of the winter again freezes up the small creeks and river

tributaries, thereby cutting down the flow of water to a second low-water period.

But, one might ask, what has this to do with system efficiency? If the rivers of the state had an absolutely constant flow during the year, a scheme of operation could be devised which would attain to a high degree of efficiency, or at least one which would need little or no attention. This, however, is a dream of conditions which could exist only in an ideal climate. Plants must be designed to handle the largest possible percentage of water discharged during the high-water periods without having a great amount of capacity lying idle during the low-water periods. These plants must be operated on a basis which will give certain desired conditions at all points on the system, regardless of individual plant efficiency. The same holds true with steam-plant equipment. Sufficient installed capacity is necessary not only to handle the required portion of the load during the low-water periods, but enough to meet any emergency which might arise through the loss of a transmission artery from one of the northern rivers. Some steam plants are subjected to the same varying load conditions at times to obtain proper system conditions.

Some of the Consumers' Power Company steam and hydraulic plants are among the most efficient in operation. There are in all twenty-two hydro-electric plants supplying current for the system. These plants range in capacity from 150 kw. to 18,000 kw. and are tied into the transmission system at points greatly removed from each other. Many of these plants are operated at their most efficient point continuously throughout the year. They are operated at the most efficient governor-gate opening, and the headwater is not allowed to drop below certain limits. The length of operation on each unit varies with the river conditions, depending on the season of the year. With all units 100 per cent governor-gate opening is practiced during maximum water periods.

The Plainwell hydraulic station operates week after week during the low-water period on a governor-gate opening of 82 per cent. This is the most efficient point. The headwater does not fluctuate more than 0.2 ft. or 0.3 ft. from crest. There are three units of equal



TWO FORMS OF RECORD FROM WHICH THE DAY-BY-DAY OPERATION OF THE CONSUMERS' POWER COMPANY STEAM AND HYDRO PLANTS IS DETERMINED

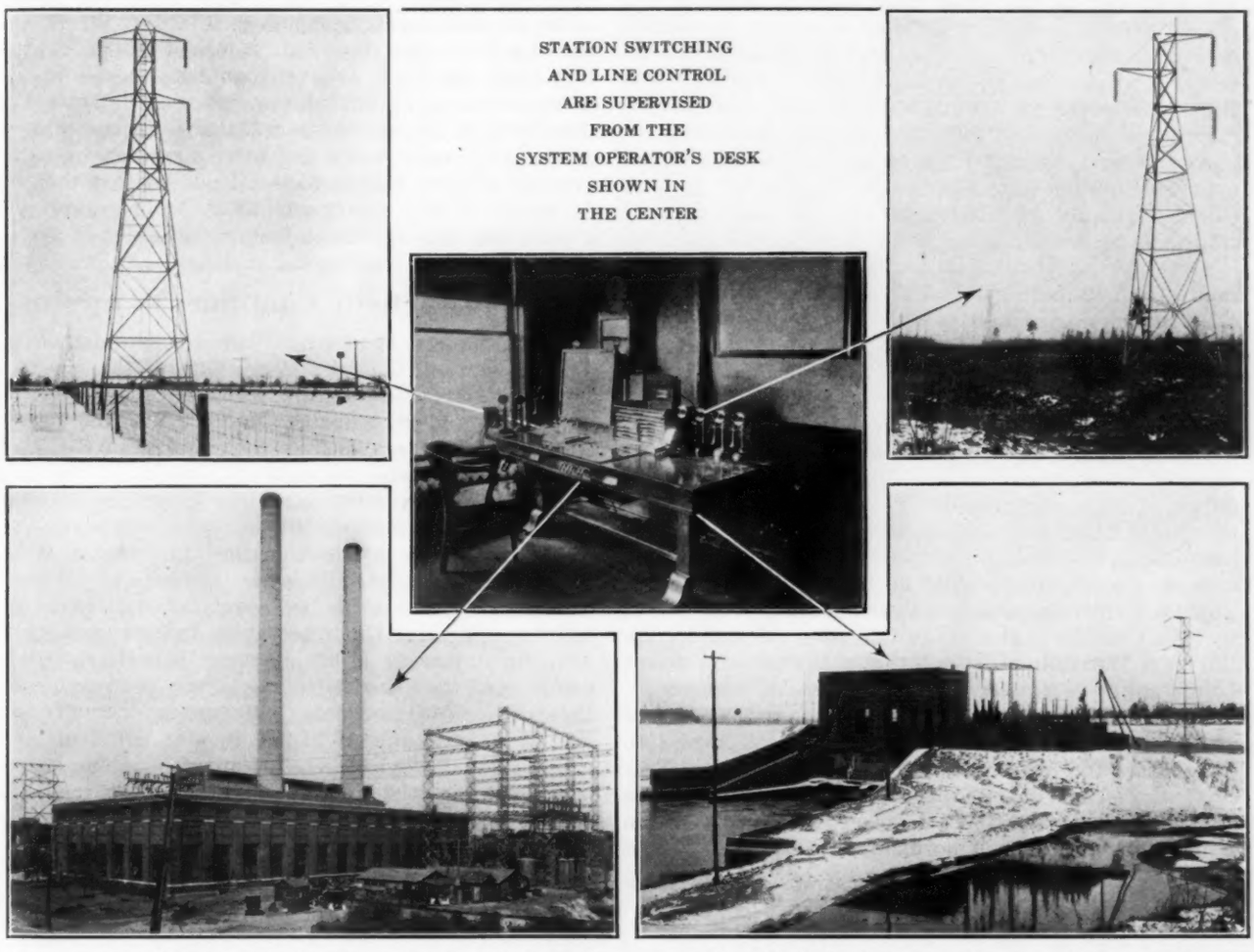
They contain the routine data on plant operation and conditions, both of water supply and the physical conditions of apparatus that can be operated.

capacity in this plant. If the river flow is greater than one unit will handle, the headwater is allowed to gain with one unit in operation at 82 per cent governor until maximum elevation has been reached. A second unit is then placed on the line at 82 per cent governor opening and the headwater pulled down 0.3 ft. At this point one of the units is taken off and the headwater allowed to return to crest. The water is handled between these limits by the use of one, two or three machines, depending on the river conditions. In this way maximum efficiency is obtained.

This scheme could not be applied throughout hydraulic operation, since it would necessitate an enlarged steam generation during the heavy-load period of the day and because there would not be sufficient load to accommodate the hydro plants during the off-peak period should several of them arrive at full head at the same time. The amount lost in fuel consumption and wasted water would prohibit this plan.

The ideal arrangement would be one which would give steam generation a straight-line curve twenty-four hours a day with a hydraulic plant operation on the plan mentioned above. As this is not possible because of the irregularity of the load, certain changes must be made affecting both steam and hydraulic stations. It must be decided what portion of the load will be carried on steam or water. If steam generation is reduced below a certain point, the system suffers by so lowering the headwater at the various hydraulic stations that inefficient operation results. On the other hand, if the headwater were continuously maintained at crest, an excessive amount of fuel would be consumed at the steam plants during the day, making it necessary to waste water at night on the off-peak period.

A compromise between these two possibilities results in better economy, which gives steam generation as near a constant daily load as possible for twenty-four hours. As the load comes on the system each morning it is picked up by the water stations, which are operated on efficient governor openings. One plant is known as a "regulating plant" and takes all the fluctuations in load. The load factor of this plant may be low at times since the load swings from no load to full plant capacity. The hydraulic stations accommodate the load drop during the noon hour, and as fast as the power load drops off in the evening the hydraulic capacity is shut down, thereby allowing the ponds to fill up for the next day's operation.



STATION SWITCHING AND LINE CONTROL ARE SUPERVISED FROM THE SYSTEM OPERATOR'S DESK SHOWN IN THE CENTER

During low-water periods when the river flow is very small it is primarily essential to keep the headwater of the various plants up to crest, since with low heads much additional steam is required to build the water level up again. If the plants are operated on low head, much is lost in efficiency. This problem is handled by the Consumers' Power Company as follows: Accurate records of each day's operation are kept both in the form of a summary of the day's operation and in hourly readings giving operating conditions at each generating plant. At midnight, when the total output figures are received from each plant by the load dispatcher on duty, a perusal of the headwater figures is made comparing them with those taken the previous night. This

shows at once whether there has been a loss or a gain in the headwater as a whole. It is then decided whether it is necessary to operate more or less steam on the coming day in order to bring the headwater back to its normal level.

Going further into the scheme of handling water conditions, the natural location of the hydraulic plants on the Au Sable River is also utilized. The Mio station is about 40 miles upstream from the other plants, which are closer together further down the river. This means that it takes approximately twenty hours for water discharged from the Mio plant to reach the other plants below. The water used one day at Mio is used the next day at the other four plants. Figures and charts have been devised so that it may be accurately determined at midnight from the previous day's output at Mio just what the value of water on the Au Sable River will be for the coming day and just what amount may be generated and full heads still be maintained.

As the total output on the system can be determined approximately, definite figures can be obtained on both steam and water. Thus there is no guesswork in cutting in boilers and placing steam units on the line.

Since certain boilers must be banked during the hours from 12 midnight to 5 a.m. in order to carry the daily maximum-demand load, the resulting steam plant efficiency is often decreased. Boiler operation at any steam plant on a poor load factor is seldom necessitated, with the exception of the operation of turbines at certain times as synchronous condensers to correct the power factor. This indicates one of the big problems in steam-plant operation. As an illustration of this point, during high-water periods it is often necessary to operate a steam plant with a large unit on a minimum load during the heavy-load period merely to maintain voltage. It is also true that an improved power factor would not entirely correct this condition since the capacity effect of the high-voltage line must be considered. But were the equipment such that a 100 per cent power factor might be obtained during the heavy load period, several units would still be required to operate as synchronous condensers during the off-peak period to compensate for transmission line capacity effect. This condition is not limited merely to one station on the transmission system, but involves great expense in order to keep conditions normal.

The operation of generating equipment for the correction of power factor is not limited to steam stations. Hydraulic capacity is sometimes operated during both heavy and light load periods daily in order to control voltage conditions at distribution centers. Several of the system hydraulic units are especially equipped for breaking the vacuum in order to be operated as synchronous condensers. Breaking the vacuum reduces the energy consumption, although approximately 200 kw. hourly is required to propel one of these units under such conditions.

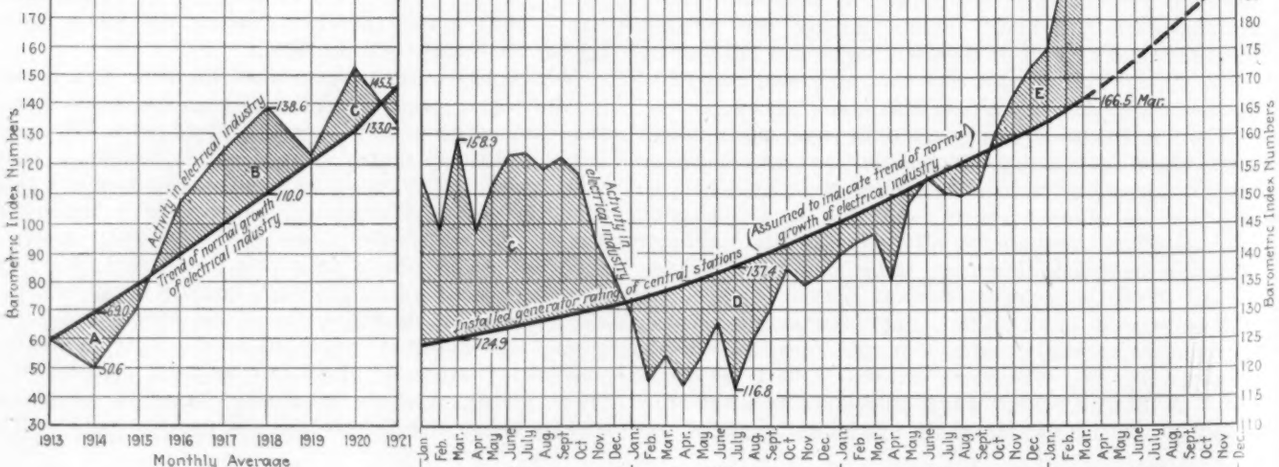
Protection to service or insurance against interruption is very important and sometimes causes inefficient plant operation. When the system is visited by electrical or sleet storms, steam generating equipment must be placed on the line with sufficient boiler capacity to handle the load, even though this means backing down on the hydraulic plants and wasting water. If the storm is severe, boiler capacity is increased at all plants and steam units are often operated over long periods on light and inefficient loads so that they will be ready if any emergency arises. This represents a necessary expenditure to insure continuity of service.

Business Activity Continues to Increase

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate another record operation within the industry during March. Pig-iron production, generally regarded as the most accurate single indicator of productive activity, made a new high record in that month, exceeding even the war-time production of December, 1918.

The basic data upon which the "ELECTRICAL WORLD Barometer" is based indicate an increase of 4.4 points on the barometer scale as compared with February activities. During this interval the industry had grown 2.2 points, leaving a net increase in activity of 2.2 points on the barometer scale as compared with February. The electrical industry as a whole was operating in March at 27.9 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In February it was operating at 25.7 points or per cent above the point of normal demand.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



Industrial Electric Heat Applications—II*

Types of Ovens and Their Field of Application—Limitations as Regards Duty and Temperature—Typical Installations Described and Operating Results Recorded—Advantages of Electric Heat Applications

By J. L. McK. YARDLEY
General Engineer Westinghouse Electric & Manufacturing Company

THERE are many types of ovens for industrial heating purposes and each has a well defined field for its application. In their use judgment must be exercised to secure best results and the proper type must be selected for the work under consideration. In order to bring out some of the commercial industrial ovens tabulations will be made with a brief comment on each type:

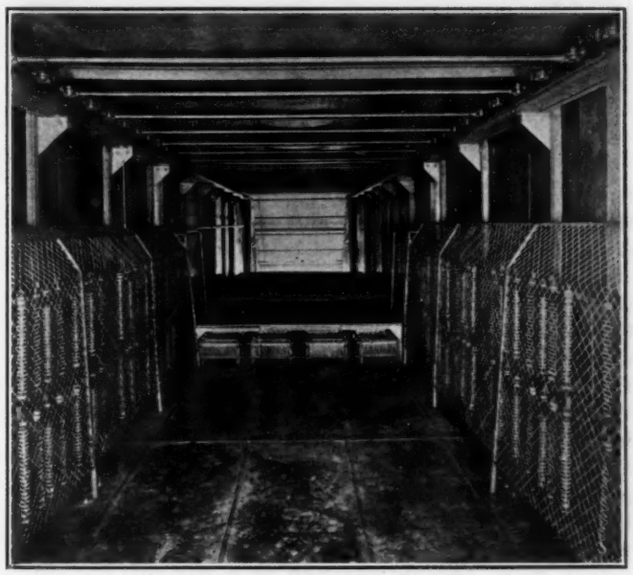
1. Electric range for the household. In connection with this application it is interesting to mention that over a test period of six months the average monthly power consumption for twenty-four families of four to six persons each was 100 kw.-hr.

2. Bread-baking ovens—reel type. One commercial size bakes 120 1-lb. loaves in a thirty-five-minute bake, which is equivalent to 175 loaves per hour. The input is 25 kw., or 7 lb. of bread are baked per kilowatt-hour. The loss to maintain the oven at the temperature required amounts to from 7 kw. to 8 kw. Larger and sectionalized types of ovens will be discussed later in their application to bread baking.

3. Enameling oven. These operate mostly at a temperature of 400 deg. to 500 deg. F., and there are many subdivisions: (a) The kiln type of oven, hand-operated, which produces 6 lb. to 8 lb. of work per kilowatt-hour; (b) the kiln type of oven, truck-operated, which produces 10 lb. to 12 lb. of work per kilowatt-hour; (c) the semi-continuous conveyor type, which produces 10 lb. to 12 lb. of work per kilowatt-hour; (d) the continuous conveyor type with air seal or exhaust fan, which produces 25 lb. to 30 lb. of work per kilowatt-hour.

In the making of bread, when the reel-type oven is used, the reel rotates and every loaf is baked equally by the heaters in the bottom of the oven. The oven, of course, is completely equipped with automatic control. In the continuous-conveyor type, which may make 1,200 loaves of bread per hour, the bread continually passes through the oven. The sectional type is made in several sizes, as from twenty to sixty loaves in a section. The idea is for the baker to buy one or two sections or hearths according to his needs and then add sections later as his bakery grows. Each section is heated from top and bottom and is provided with independent automatic control. The circuits are controlled by a motor-operated snap switch, which in turn is actuated by a small thermostat in the usual manner through the effect of furnace temperatures.

The heaters in the kiln-type oven are usually mounted in a vertical rather than in a horizontal position. The fresh air coming in at the top and passing through the heating elements at the side of the oven takes up the vapors which are heavier than air and is then exhausted from the bottom of the oven. This type of oven is largely used in the automobile industry and in furniture enameling. In some arrangements baffles with slits for admitting air to the interior of the oven are provided extending from the bottom to the top, and heaters are placed behind the baffles. The air inlets are placed beneath the heaters and the air passes up through the heaters and out through the slits into the baffles and into the oven. Fans for supplying the air are installed on the top of the oven.

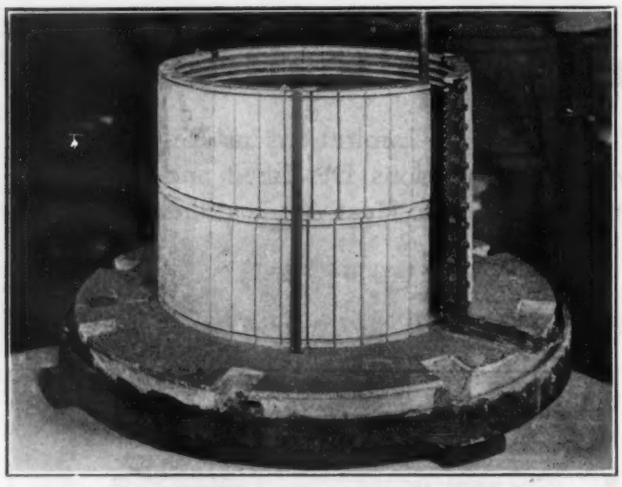


A CONTINUOUS-CONVEYOR-TYPE OVEN FOR THE BUICK MOTOR COMPANY, DETROIT

Smaller ovens of the kiln type are made for hand operation. For example, a small oven with interior dimensions approximating 3 ft. x 3 ft. x 3 ft. is equipped with four 2½-kw. oven-type heaters and with the degree of heat insulation employed comes up to a temperature of 550 deg. F. in forty-five minutes. With power cut off, the temperature drops in two hours and ten minutes to 300 deg. F. Three kilowatts is required to maintain this temperature. The oven is designed to be operated with full automatic control at a temperature of 450 deg. F. The average thermal conductivity is approximately 0.8 B.t.u. per inch per square foot per degree Fahrenheit. Another size of hand-operated kiln type of oven in practical use has interior dimensions of approximately 4 ft. wide, 4 ft. high and 3 ft. deep.

Ovens of the semi-continuous conveyor type are being used extensively in the automobile industry, for example, at the Jordan Motor Company's plant, Cleveland. Here the work coming through the oven is allowed to

*This article is based on an address given by the author before the Toronto Section of the A. I. E. E. and the A. S. M. E.



ASSEMBLY OF HEATING ELEMENTS FOR 750-LB. SOLDER POT

hang on the conveyor over the drip tank. The work then passes into the oven and is baked while the conveyor over the drip tank is being filled again.

In the continuous-conveyor type, which is extensively used, the work goes through the oven continuously. One of the largest installations is at the Royal Typewriter Company's plant for the enameling of typewriter frames. Another large oven is installed at the works of the Buick Motor Car Company in Detroit. This oven has a capacity of 1,550 kw. The heating elements are all protected by screens. On the entering end they are mounted on the side walls and on the exit end on the floor. The reason for mounting them on the side walls at the entering end is that the work drips to some extent while passing through this part of the oven. Separate exhaust flues from the oven are brought outside to dissipate the noxious gases. This oven has been so satisfactory that it is now being practically duplicated in an extension of the same plant.

SMALLER APPLICATIONS

The heating element in solder and babbitt pots is of considerably different construction from the others

MOLTEN SALT IS USED IN THIS FURNACE AS THE RESISTOR ELEMENT; HEAT TREATMENT OF TOOLS TO 1,450 DEG. F. PRELIMINARY TO HARDENING

used. It may be operated up to a maximum of about 1,800 deg. F. and hence is applicable for work of 1,000 deg. F. or perhaps 1,200 deg. F. The 30-lb. preheat type of solder pot consists of a cast-iron shell lined with 1-in. molded insulation. The heating elements are directly underneath the cast-iron pot and are insulated by 1½ in. of "Nonpareil" brick. The brick is placed directly in contact with the heating elements and above the wire, so that all connections are amply protected. With terminals at the bottom it is well arranged for conduit attachment. About 1,300 watts is required to bring a 30-lb. charge to a temperature desired in fifty-five minutes; 650 watts is ample to keep the charge at temperature.

HEAVY-DUTY-TYPE INDUSTRIAL FURNACES

The heavy-duty type of industrial furnace employs heating elements made of nickel chrome alloy. These elements are placed in grooved refractories or muffle plates of special composition which is a good dielectric and at the same time is a good conductor of heat. The heating elements, together with the grooved refractories, are held in position by T-shaped supports which fit loosely into recesses in the sides and roof of bricks. All terminals and connections between heating elements are made on the outside of the furnace. When operating on work the temperature of which is within 100 deg. or 200 deg. of that permissible for the elements, the intervening muffle plates are eliminated and the heating elements are arranged to radiate as directly as possible upon the work. It is obvious from the type of construction that there is no reasonable limit mechanically or electrically to the size to which this type of furnace may be built, and that it may have single or double doors. In the larger furnaces, of course, a substantial framework is required to carry the weight, and where heavy-duty work is involved the same attention to mechanical strength and ruggedness as in fuel-fired furnaces must be given.

The field for this type of furnace is very extended, being limited principally by the fact that the resistor itself cannot be operated for any appreciable length of time at more than 2,100 deg. F. An increasing number of these furnaces are being installed. Among others, arrangements have recently been made for the installation of the following, showing the variety of applications: A 60-kw. furnace for the treatment of wire, hardening at 1,650 deg. F., tempering at 900 deg. F.: a 210-kw. furnace for vitreous enameling at 1,800 deg. F.; a 33-kw. furnace for lead-bath treatment of steel saw blades at 1,600 deg. F.; a 220-kw. furnace of car-bottom type for the heat treatment of locomotive parts, piston rods, crankshafts, etc.; a 160-kw. pot and retort for the refining of sulphur, melting at 350 deg. F., distilling at 850 deg. F.

FURNACE WITH MOLTEN-SALT RESISTOR ELEMENT

In the extensive search which led up to the development of the industrial heat-treating furnace of metallic resistor type, many other types of furnaces were, of course, tried out. It is of interest to refer to one or two of these which have given satisfactory results in practical operation.

In one of these a molten salt is employed as the resistor element. The furnace is used for the heating of carbon-steel tools, reamers, etc., at a temperature of 1,450 deg. F. preliminary to hardening. It consists of a cast-iron cylinder 4 ft. high and 4 ft. in diameter,

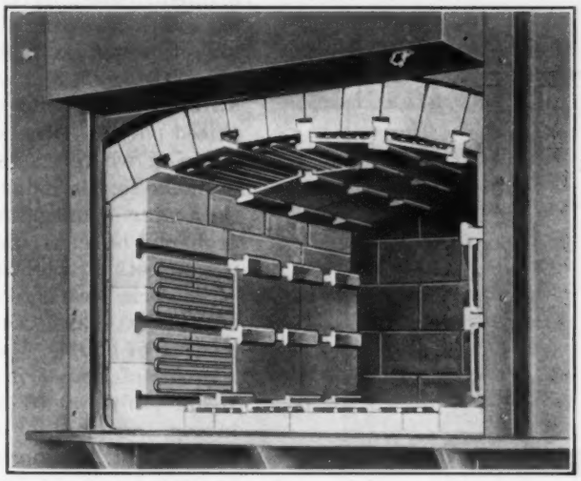
open at the top and filled with firebrick, except for a well at the center 9 in. in diameter and 14 in. deep. Four blocks of carbon are built into the walls of the well, two on each side, and are connected to the electrical circuit. Power is supplied by a 24-kva., 30-volt to 60-volt transformer and switching panel. The furnace is started by connecting the carbon blocks by carbon rods. A mixture of dry barium chloride and sodium chloride is fed in and melted by the heat from the rods. The rods are then removed and the salts are kept molten at temperature by the passage of electric current through them. A number of advantages have been claimed for this type of furnace:

1. The temperature of heat treatment can be altered by varying the proportions of the salts employed.

2. For any given mixture of barium chloride and sodium chloride, or other salt, a practically uniform temperature is obtained.

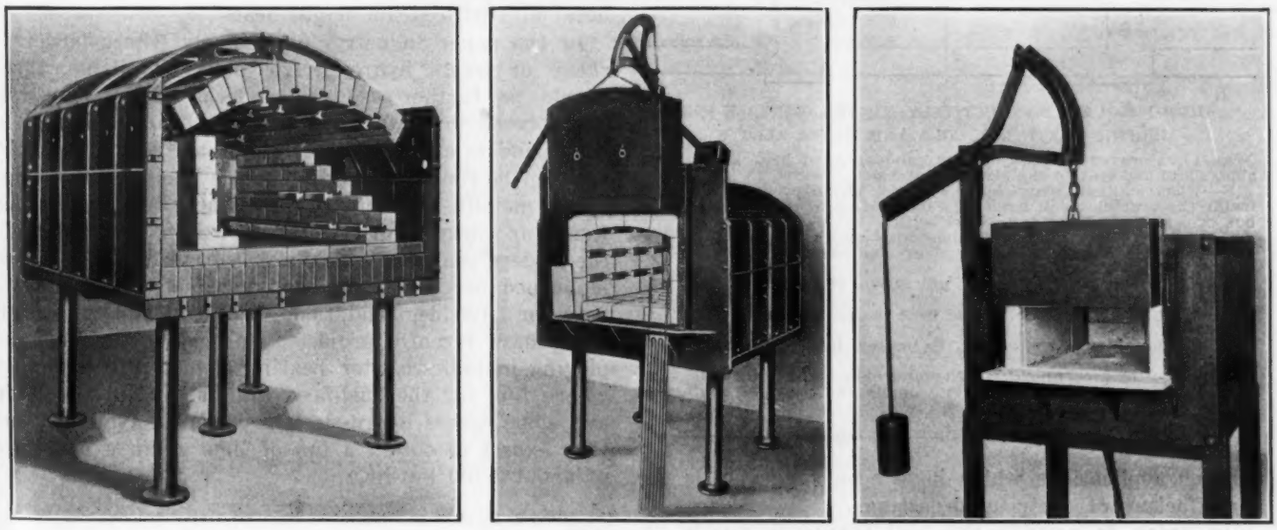
3. The metal under treatment is in no danger of burning or scaling.

4. The cutting edge of a tool can be heated to any desired depth for hardening.



5. Labor cost in tool hardening is reduced and production increased.

As has been mentioned, the chromel resistor is not good for maximum working temperatures above approximately 2,100 deg. F. In searching for a resistor material which could be used in furnaces for applications requiring temperatures above 2,000 deg. F., and after a number of unsuccessful attempts had been made to use carborundum or silicon carbide for such work, a furnace was devised which shows considerable promise for the future. In this furnace the resistor element consists of a pile of carbon plates held together by spring pressure. An experimental furnace of this type has been kept at a forging temperature of 2,300 deg. F. for six weeks at a time and used in an extended operation, heading bolts. This furnace is 4 ft. long, 3 ft. deep and 4 ft. high over all and is mounted on 2½-ft. legs. The chamber is 30 in. long, 9 in. deep and 20 in. high. It takes from 16 kw. to 40 kw., 1,000 amp. to 1,200 amp., over a 20-volt to 60-volt range. In the operation of heading bolts the input was from 16 kw. to 22 kw. for small and medium-sized bars. The carbon resistor plates are 6 in. x 2½ in. x ¼ in. thick, and the pile of plates is held together by 200-lb. spring pressure. The heating element has been found to handle 100 kw. safely. Water-cooled bronze terminals are provided. The roof above the element consists of 4-in. x 4-in. carbon bars covered by from 6 in. to 8 in. of carbon dust and two layers of insulating brick. "Carbofrax" and firebrick are used in the side wall. It was found that the element must be protected by oil or gas flame from oxidization in order to have reasonable length of life. One gallon of oil or 100 cu.ft. of gas per day was sufficient. It was also found that the life of the element could be extended materially by changing the construction so as to seclude the element from the furnace chamber in a trough covered by "Carbofrax" brick or by a carbon plate protected by a covering of coke dust or granular carbon, and the earlier experimental construction is no longer used.



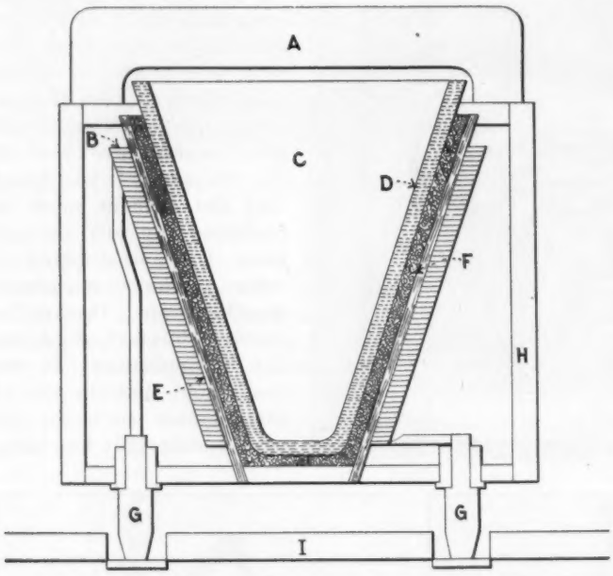
HEAVY-DUTY TYPES OF INDUSTRIAL FURNACE

Chromel-metal heating elements are placed in grooved refractories or muffle plates and are held in position by T-shaped supports fitting into recesses in the sides and roof, which are made of fire brick.

While the future for this type of furnace in forging work looks promising, the same principles have been employed in an experimental way in a muffle-type calcining furnace and also in a brass furnace, and the interesting results have been in the brass furnace, with an input of 50 kw., 100 lb. of metal in cold pigs has been melted in fifteen minutes.

A review of what has been done and the possibilities for the future in high-temperature work could be incomplete without reference to high-frequency inductive

heating, by which method temperatures above 2,550 deg. F. are readily obtained without carbon being essentially associated with the operation of the furnace. This type of furnace seems to have a multitude of applications. One of these is the melting of metal and alloys where low volatilization losses are essential, as in the case of molybdenum, platinum, gold and silver alloys. The furnace may also be used in graphitization work, when the carbon blocks to be graphitized are embedded in lampblack or carbon black, or in the heat treatment of knife blades and thin steel sheets. One of the miscellaneous applications which have been suggested is the manufacture of centrifugal castings.



HIGH-FREQUENCY INDUCTIVELY HEATED CRUCIBLE FOR MELTING PLATINUM, GOLD AND SILVER ALLOYS

A—Lid; prevents radiation and conduction of heat to the outside, confining heat to the crucible interior.
B—Electrical coil; carries the current, which produces the heat inside the crucible; coil itself is water cooled, making the furnace box cool and comfortable to work with.
C—Metal; where the heat is generated and left.
D—Crucible lining; holds the metal and helps keep the heat in the crucible.
E—Electrical insulation; for protection and to help keep the heat in the crucible.
F—Heat insulation; keeps the heat in the crucible where it is generated.
G—Terminals; where circuit is broken by lifting crucible to pour.
H—Box; for mechanical rigidity and ease of handling.
I—Table; supports the electric crucible and provides contact to the electrical power supply.

In order to provide the high-frequency power required for this type of heating, a frequency converter is employed for sizes up to 20 kw. per phase. This converter consists of an oil-cooled transformer with internal reactance, a set of static condensers and a metal discharge gap. For larger capacities it seems probable that a high-frequency alternating-current generator will be required. Such generators have been built and are obtainable. The electrical manufacturers appear to have no hesitancy about building this type of generator in larger sizes of, say, 200 kw. or 400 kw., at a frequency of 10,000/12,000 cycles, and it is probable that such capacities will take care of all the applications of this type of furnace.

The future will see a greater application of electric heat. Glass annealing will undoubtedly be done to a much greater extent by electricity. A total possible connected load of 60,000 kw. has been estimated. It is considered that the temperature gradients in the mass of homogeneous glass are solely responsible for the setting up of strains. Very accurate temperature control, such as is obtainable by electrical means, is therefore desirable. This should be within plus or minus 4½ deg. F., and the temperature required usually lies between 1,000 deg. and 1,450 deg. F.

An interesting account of the boiling of linseed oil with electric heat appeared in *Chemical and Metallurgical Engineering* for Nov. 2, 1921, page 844, and an account of the use of electric heat in the Western mining industry for the drying of fine concentrates, printed in the *Engineering and Mining Journal* of May 28, 1921, gave cost figures of from $5.66 to $6.86 per ton of water extracted with power at 0.65 cent per kilowatt-hour. Many other processes will be electrified, owing to the superior quality of product, even with high-priced power. Others will be electrified where power is cheap or where waste hydro-electric power is available.

In the textile industry in some localities the slashers, the tentering machines and the singeing machines will probably be electrified, as well as the dye vats and various other apparatus. In considering the extension of electric heating into this industry, the following advantages have been indicated: (1) More uniform heating of liquids, dyes and size; (2) more uniform consistency of liquids in dye vats, etc.; (3) elimination of steam piping and its losses; (4) higher temperature, taking the place of additional dry cans in increasing production; (5) higher temperatures in calender rolls and more uniform temperature throughout rolls than is obtainable with steam or gas heat.

In the paper industry, particularly where power is cheap or waste hydro-electric power available, there should be further use of electrical heat. This will probably be in the cylinders of the board machine, in the calenders and in the general steam requirements.

Even the time-honored limekiln is likely to be invaded by the metallic-resistor heating element some time when waste or cheap hydro-electric power is available. In the modern coal-fired limekiln 500 lb. to 1,000 lb. of coal is burned per ton of lime produced at a temperature between 1,100 deg. and 1,650 deg. F. Industrial engineers have recently projected an electric limekiln employing metallic-resistor heating elements in a locality where fuel for the fuel-fired kiln is difficult to obtain and some excess hydro-electric power is available, and they expect to obtain a ton of lime at an expenditure of about 3,400 kw.-hr.

Germans Seek to Hasten Electrification

UNQUALIFIED public and professional interest is centered on the German government's present efforts to circumvent the coal shortage by the electrification of all state railways, says United States Consul B. S. Hayen, Leipzig, in a report to the Department of Commerce. By demonstrating the superiority in service and economic efficiency of electricity over steam it is hoped to offset the handicap to German railway transportation resulting from the occupation of the Ruhr coal fields and the deliveries previously made under the Versailles Treaty. Not only railways, but factories, will be compelled to use electric power. Lack of coal has forced the German State Railway Administration to withdraw a large number of trains. Even now the remaining trains run principally on imported English bituminous coal. Leipzig is already the terminus of several electrified lines.

Man Development in Public Utility Companies*

The Personnel Problem that Confronts Every Central-Station Manager—His Responsibility to Either Release or Build Up His Men

BY H. A. LEMMON
Personnel Department, Stone & Webster, Inc., Boston, Mass.

PROBABLY all central stations have men in their employ who are not equipped temperamentally or otherwise to gain success in this very exacting business, and yet who are gifted in many respects and still young enough to prosper in other lines. Perhaps many of these were employed at a time when of sheer necessity standards were somewhat relaxed. Presumably they have rendered the best service that they are capable of giving, and if so are clearly entitled to sympathetic consideration.

Utility managers should frankly discuss the situation with all such, picture to them the probability of a greater measure of success in other lines, advise with them, and help them to become established in new activities. One may expect that within a reasonable time the industry as a whole will become more active. Men will then be in greater demand than now, and every effort should be made to assist "misfits" in obtaining employment with some other concern conducting a business more congenial to them. Even with present conditions, it is not clear that the industry is making as earnest an effort to accomplish this very desirable improvement as it can and should.

Any one can eliminate many applicants for positions as being ill trained or temperamentally unfit, but no man can and no system has yet been devised which will eliminate all of them. However, certainly two years' observation at most of a young man actually on the job and associating with his fellow employees and coming in contact with people outside should be a sufficient time in which to enable one to determine his fitness for public service. If there is any substantial doubt in the minds of his superiors, he should be carefully tested and considered, and if still found measuring up as anything less than desirable, he should be weeded out. Fairness to the man himself, if there were no other consideration, dictates this course. Yet we have not always so done, and the fact that we have not is responsible for the further fact that unfortunately there is much dead wood in many departments of most companies.

If we do not part company with the undesirable employee in the early stages of his employment, we are certain to wish to do so later, when perhaps so many years have elapsed that we are responsible for a conviction on his part that his position is permanent, and that, too, when he has passed the period of mental flexibility which would have enabled him to begin all over. We assume a tremendous responsibility by retaining in our service any newly made employee unless we are reasonably certain of his adaptability. It is no hardship to discharge a *young* man from the employ of an industry to which he does not belong, but it is nothing less than a tragedy to turn loose upon the world an old man whose long years of employment with us have robbed him of ability to adapt himself to other conditions. Our industry will avoid this crime against the man if it will be more ruthless at the beginning.

Promotion from time to time and increase in salary, however small, are official notice to the employee that he is making good. Except in rare circumstances, no such notice should be given unless it is a really significant one and will be interpreted by the employee. In times gone by some utility managers have been guilty of recommending men for promotion for the sole purpose of getting rid of them. There is the typical case of a man who was recommended for, and received, five transfers to other companies and only after seventeen years' service was there found a manager with courage enough to proclaim him unsuited to the business, and yet in going back and interviewing fellow employees and superiors who had been with him at various parts of his career it was learned that he never had been desirable in any of his previous positions.

His first manager admitted this to be true and yet recommended him for transfer and promotion. It would have been easy to have corrected the mistake of his employment when his deficiencies were first discovered, inasmuch as he is a man of intelligence and industry and doubtless would have enjoyed a reasonable measure of success in some other line of business. Moreover, he was an unmarried man at the time when his faults should have been first discovered and was without serious financial responsibilities. Now he is the sole support of a mother, a stricken father, and has an invalid wife and two children, one of whom is feeble-minded. Lack of courage to face an unpleasant duty, or lack of interest, has robbed that man and his family of seventeen years of his life—more than that, it has robbed him of his chance for a future of reasonable contentment and progress.

We talk much of accident prevention. We might well interpret this to mean the exercise of our best efforts to prevent accident to the material welfare of our employees—a paralyzing disaster to the daily lives of the "misfits."

There appears to have grown up in the minds of some company officials a feeling that the young man sent to them from the headquarters office comes stamped with the parent organization's seal of approval. Such is not the case. Six to eight months in the home office, under supervisions, may or may not tell the story. Many a young man develops traits and characteristics in the field of which he gave no visible evidence while

THERE is no single problem of utility operation today more deserving of executive attention and guidance than that of the development of personnel. Whether the central-station staff number, twenty-five employees or five thousand, the importance of those individuals to that organization is equally vital. For here is a public service corporation, owned by the people through share holding, regulated by a popularly appointed commission, and dependent for its prosperity upon public sympathy and approval. Its employees are in constant contact with the people of the community it serves, and only by their representation is the company known. The kind of men and women who work for and speak for the light and power company make the character of the company in the mind of all its present and prospective customers. The question is how can the right kind of personnel be developed? It is this point which Mr. Lemmon discusses in this article.

*From a paper read recently before the Stone & Webster managers.

in the head office. These young men are on trial, and with precisely the same standing as the young men a local manager employs. Give them no favors. Judge them on their merits, and if found wanting, notify the department head from which they were sent.

No proper manager will recommend for promotion any man whom he would not like to keep in his own organization. Consciences in the past have sometimes been anesthetized by the thought that perhaps the man, though a failure with his present manager, would be successful if he might be transferred to a different environment. This actually occurs just frequently enough to prove that the theory is not without foundation in fact, but it is the exception rather than the rule, and in any event we can much better justify losing a few good men than we can justify becoming committed for the future of many indifferent ones.

Men are developed by having increased responsibilities placed upon them—ordinarily through promotion in the company with which they are connected or by transfer to a similar position in a larger company. Transfers are expensive to all parties concerned, but many years' experience of the Stone & Webster organization has demonstrated their efficiency and their desirability. They are rendered extremely difficult, however, in many instances by managers demanding a finished product to fill their open positions, instead of being content with a man who has had some experience but who, above all, can quickly grow into his new work. Unless the new job is actually a bit bigger than the man who is transferred to it, nothing whatever has been gained by the change except the filling of a position, while on the other hand an opportunity for man-development has been lost, perhaps for years. Every company must be a training school in continuous operation.

If we might take any given company and start fresh, selecting its new personnel from any and all available sources, the problem of building up that particular organization would be extremely simple. However, there is no such happy and easy solution. What we actually have to do in practice is to take such units as we now possess—inefficient and otherwise—working each over into the things he can do best and thereby shape all into a smooth-working machine. Some of our own companies present remarkable illustration of the possibilities of creating an unusually strong organization without any stars in the cast.

SUPERVISING AND GRADUATING MEN

Supervision is the magic formula for producing results in either man or property development, but as applied to men it doesn't mean sleuthing and, above all, it doesn't mean nagging. The failures of employees' associations, clubs and benefit societies, staff conferences, company spirit and cohesion and so on are almost invariably due to lack of the right sort of supervision. One cause of man failure in industry as a whole—and perhaps to a considerable extent in our own—is a natural tendency to set aside a considerable group of employees as occupying merely minor positions. In the public utility business—both from a standpoint of public relations and man development—there is no such thing as a minor position.

It has been said that if we very materially raise the standard of our personnel we cannot hold many of the best of our recruits—that they will not be able to advance as rapidly with us as their talents merit, and that therefore we shall find ourselves in the position of training men for other institutions. Even so, we can view many things with less equanimity than a situation in which our personnel shall be largely made up of brilliant young men who, having been trained in both the Stone & Webster spirit and ideals, will often enter into commanding positions with other great leaders in industry and still retain their affection and their regard for our organization. Promoting men out of our organization into better positions with others—under proper conditions—is not to be contemplated with alarm but with pleasurable anticipation.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Relative Fields of Space Radio and Carrier Current

To the Editors of the ELECTRICAL WORLD:

I was very much interested indeed in the article by R. C. Denny of the San Joaquin Light & Power Corporation regarding its experience with radio telephones. The article is an excellent one and is timely.

In my opinion, a sufficiently strong case could have been made for the radiophone without putting arbitrary limitations on the carrier-current system. The carrier-current system will not, of course, meet all needs. However, we do not know its limitations even in the present first stage of development, and we should not therefore set up any limitations on its use at this time except the one limitation that there must be only conductors running between the two points between which we desire to communicate.

The article brings out the long distance over which broadcasting has been heard and the number of these long-distance receptions. It would be very interesting to know also how reliable the radio communication will be between the stations during the summer period when static is bad, and most particularly during lightning storms. Lightning is one of the major causes of transmission and station trouble in many districts, and a communication system which is put in with the idea of functioning at the time of electrical trouble when other means of communication have been interrupted should, of course, have very nearly 100 per cent reliability at these particular times.

The use of a loop receiving set with possibly some added features to improve selectivity works in the direction, of course, of reducing the effect of static. It is probably safe to say, however, that even the loop receiver will not permit completely reliable communication unless the received signal is exceptionally strong. It would seem that a 50-watt transmitter would not give a sufficiently strong signal over a distance of 135 miles to permit reliable communication during storms in that vicinity.

In this particular regard the carrier-current system appears to offer greater reliability than the radiophone system.

The radiophone will undoubtedly be used by a large number of companies operating over long distances, and the choice between a straight radio system and a carrier-current system can only be properly made after all elements that have a bearing on the case have been considered. We should not set up arbitrary limitations for either system and discard it on these assumptions.

The estimate of $1,000 per set, including transmitter

and receiver, is perhaps a little modest when all costs, including erection, are considered. However, the expense of $2,000 or $3,000 is small if it results in restoring service more quickly just a few times a year on a system of any magnitude.

The extension of the use of the carrier system can be made more rapid by continued reference to the installation of this means of communication as additional companies adopt it. This would be accomplished, of course, by each company submitting its experience in an article on the application of carrier current to its system when the system is installed.

E. P. PECK,
General Superintendent Electrical Department.
Utica Gas & Electric Company,
Utica, N. Y.

The World's Greatest Reservoirs

To the Editors of the ELECTRICAL WORLD:

My attention has been called to a letter by Wilhelm Fleischer, supervising engineer for the Norwegian Hydro-Electric Nitrogen Company, Norway, which appears in your issue of April 21, 1923, page 922. Mr. Fleischer states that his company has in Telemarken, Norway, the second largest reservoir in the world, the capacity being given as 768,000,000 cu.m.

Let me point out that the Quebec Streams Commission completed in the year 1917 what it asserts to be the largest storage reservoir for power purposes in the world. The Gouin Storage Dam, in the upper part of the St. Maurice River watershed, in the Province of Quebec, Canada, assures the control of the water which is supplied from a drainage area of 3,650 square miles (9,456 sq.km.). The reservoir created by this dam has a capacity of 160,000,000,000 cu.ft. (4,500,000,000 cu.m.), and its area is 300 square miles (780 sq.km.).

The Gouin reservoir is twice as large as the Assuan reservoir.

O. LEFEBVRE,
Chief Engineer.
Quebec Streams Commission,
Montreal, P. Q.

[The following tabulation of the approximate capacities of the largest reservoirs in the world is of interest in this connection. It is possible that some large European reservoirs are not included. The capacities are stated in millions of gallons. The figures for the American dams were compiled by the *Engineering News-Record*. That for the Assuan Dam is derived from an article in the *Engineering News* for Sept. 30, 1909, by F. H. Fowler, who puts the storage capacity of the reservoir before its enlargement at 795,000 acre-feet. According to the *Encyclopædia Britannica*, the raising of the dam, completed about twelve years ago, increased the former capacity two and a half times. This factor applied to Mr. Fowler's estimate figures out as indicated below, making the Assuan basin rank fourth in size. The *Encyclopædia Britannica's* own figure for the entire 200-mile reservoir created in the Nile was 3,750,000 millions of cubic feet with the old dam. Multiplied by two and one-half and converted to gallons this gives the enormous figure of 70,312,500 millions. Obviously, estimated in this way the Assuan reservoir is not comparable with any other.

	Millions of Gallons		Millions of Gallons
Gatun (Panama)	1,373,000	Moosehead Lake (Maine)	177,000
Gouin (St. Maurice River, Quebec)	1,200,000	Ripogenus (Maine)	157,000
Elephant Butte (New Mexico)	863,000	Clear Lake Klamath (Oregon)	150,000
Assuan (Nile River)	650 000	Shoshone (Idaho)	149,000
Roosevelt (Arizona)	425,000	Ashokan (New York)	132,000
Pathfinder (Wyoming)	349,000	Twin Lakes (Maine)	123,000
Lake Winnibigoshish (Minnesota)	338,000	Hebegen (Montana)	115 000
Jackson Lake (Idaho)	276,000	Tirso, not completed (Sardegna, Italy)	110,000
Burrinjuck (Australia)	252,000	Medina (Texas)	98,000
Leech Lake (Minnesota)	247,000	Big Meadows (California)	96,000
Mosvand, Telemarken (Norway)	203,000	Bridgewater (North Carolina)	94,000
		Lahontan (Nevada)	94,000
		Arrowrock (Idaho)	91,000

Of these dams the last-named, at Arrowrock, Idaho, is the highest. It measures 354 ft. to the top of the parapet wall.—EDITORS.]

Underground Transmission at 150,000 Volts

To the Editors of the ELECTRICAL WORLD:

The Pacific Coast practice of joining distant power stations by a network of tie lines and operating them as a unit has gradually spread eastward until it has invaded the populous regions where electrical transmission must be of necessity by underground cables. The interest now being shown in "superpower systems" indicates that the near future will see an important demand for insulated cables of increasingly higher voltages.

The city of Paris has a 60,000-volt system using single-conductor cables, and a large system in the Middle West is now contemplating 132,000-volt underground transmission. The day when 150,000-volt underground systems will be required is not far distant.

A well-known professor of electrical engineering told his students that the problems he gave them differ from those they would encounter in practice in that the former were always capable of solution whereas the latter seldom were. Then, with a twinkle in his eye, he added that insoluble problems could generally be solved by eliminating certain unessential conditions which had been unconsciously assumed and thereby converting them into soluble problems. The insoluble problem of cable engineering is to make insulation of a fixed thickness and slowly improving quality carry greater and greater transmission voltages. The unessential condition in this case is the assumption that the transmission voltage cannot be raised without putting a greater stress on the insulation. Years ago, however, the invention of the three-phase system with grounded neutral enabled the transmission voltage to be raised 73 per cent without increasing the stresses in the insulation, proving this assumption to be unnecessary.

A. M. Taylor* has carried this idea further, first by conceiving of a six-phase instead of a three-phase system which would increase the ratio from 1.73 to 2.0. He then amplifies this scheme by resolving each phase of a three-phase star into six components 60 deg. apart by bringing the other two phases into play through special transformers. He thus obtains an eighteen-phase system for which six three-conductor cables are required. The transmission voltage then becomes three and one-third times the voltage between adjacent phases, so that 45,000-volt insulation may be used for 150,000-volt transmission.

Mr. Taylor proposes to use concentric three-conductor cables, but all the advantages of the scheme would not be lost if ordinary triplex cables were used, as its essence is to place conductors between which the diametric voltages are imposed in different cables and thus split the insulation into separate elements. Mr. Taylor's paper is largely devoted to an extended and somewhat complicated account of this idea. The details of his calculations may be questioned by American engineers who are prepared to operate their cables at higher temperatures and stresses than he assumes, but the general idea is well worth consideration where the complication of transformers and switching apparatus which is involved is not too serious a factor.

The real interest in the scheme is the idea of raising the transmission voltage to such a high value compared with the voltage between conductors. Perhaps other and simpler ways of doing this may be devised.

WILLIAM A. DEL MAR,
Chief Engineer.
Habirshaw Electric Cable Company, Inc.,
Yonkers, N. Y.

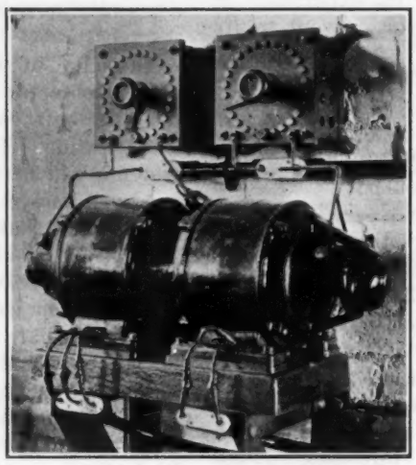
Journal I. E. E., London, February, 1923.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Protection for Frequency-Changer Sets

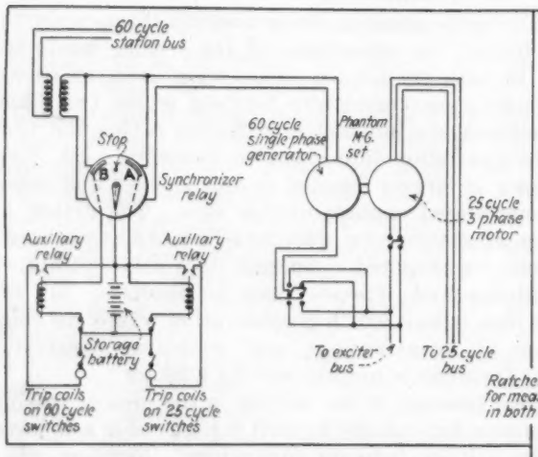
WHERE two systems of different frequencies are tied together through frequency changers it is difficult to provide relays which will protect the machines against overload and at the same time permit an interchange of power between the systems. The Central Arizona Light & Power Company has recently perfected a novel device for overcoming these difficulties. It consists of a small phantom synchronous motor-generator set and a contact-making synchroscope, shown in the accompanying illustrations.



PHANTOM MOTOR-GENERATOR SET WITH CONTACT-MAKING SYNCHROSCOPE PROTECTS FREQUENCY CHANGERS

The city of Phoenix, Ariz., is supplied with power from two sources, one source comprising a group of five hydro-electric plants, part of the reclamation system of that vicinity, which deliver energy over an 80-mile line. This system, with an aggregate rating of about 19,000 kw., operates at 25 cycles. The Phoenix company converts this 25-cycle power to 60 cycles for local distribution by synchronous motor-generator sets and rotary converters with a total rating of about 4,500 kw. Power is also obtained at 60 cycles from the hydro-electric and steam plants of the Arizona Power Company over an 85-mile line. This system has a total capacity of 12,000 kw. and is tied into the Phoenix buses. The motor-generator capacity at the Phoenix plant is in several units, so that at times less than 1,000 kw. is in service to hold in synchronism a 25-cycle system of 19,000 kw. and a 60-cycle system of 12,000 kw. Exchange of power is sometimes desired from one of these systems to the other through the motor-generator sets. When either system experiences severe transmission disturbances or develops a sufficient fluctuation of speed by reason of overload, the motor-generator sets, being of insufficient capacity to hold the other system in synchronism, are thrown out of step, subjecting the station apparatus to severe strains. These strains were such that the slot wedges of the generator stators have been pulled out and the cement grouting under the bedplates driven out for a distance of several feet. Reverse-current relays in both of the incoming line could not be employed to protect the frequency changers from these strains because of the desire at times to exchange power between the two systems. After ineffectual efforts to obtain a relay which would permit the flexible operation desired and at the same time protect the motor-generators, the apparatus described here was devised by H. L. Aller, vice-president of the company. A small synchronous motor - generator set was built, the 25-cycle motor of which is operated from the 25-cycle buses. The 60-cycle generator has but one phase winding, correctly placed to correspond with the windings of the large frequency changers. This winding is connected to one winding of an old synchroscope, the coils of which would permit of continuous excitation. The other winding of the synchroscope is connected to the corresponding phase of the 60-cycle station bus. The phantom generator is not paralleled with the 60-cycle system, and, being without load, the synchroscope shows at all times the difference in phase

FREQUENCY-CHANGER PANELBOARD



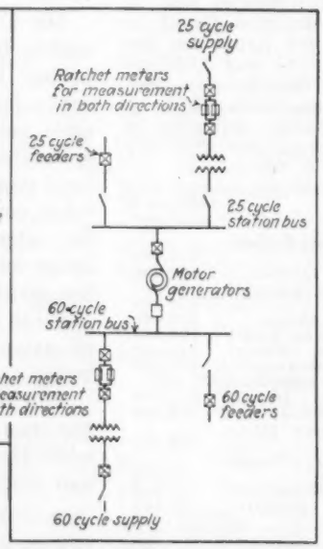


FIG. 1 (ABOVE)—SCHEMATIC DIAGRAM OF PHANTOM MOTOR-GENERATOR AND SYNCHROSCOPE RELAY CONNECTIONS. FIG. 2 (AT RIGHT)—DIAGRAM OF 25-CYCLE AND 60-CYCLE STATION CONNECTIONS

relation between the two generating systems. When either system begins to lag in speed, the synchroscope needle is deflected from its zero or normal position, the direction of deflection being dependent upon the relative speeds or frequency of the two systems. The exact position of the synchroscope needle when the frequency changers are pulled out of step was ascertained by trial, and contact-making plates were placed in the synchroscope face at these positions. When the needle touches plate *A* (Fig. 1) a positive acting relay, through the station storage battery, opens all of the switches connecting the Phoenix station to the 25-cycle system, leaving the Phoenix load connected to the 60-cycle system. The reverse action of the synchroscope makes contact with plate *B* and in like manner isolates the 60-cycle system, leaving Phoenix feeding from the 25-cycle system. An exchange of power can be effected from either system to the other up to the point when the motor-generators would pull out of step, at which point the system being fed is thrown off and entirely disconnected.

W. C. HORNBERGER,
Assistant General Manager.
Central Arizona Light & Power Company,
Phoenix, Ariz.

Extracts from Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Operating Centrifugal Pumps for Boiler Feed

THE discharge and suction valves of boiler-feed pumps of the centrifugal type may be kept open because a check valve is placed on the outlet of all such pumps. The equalizing connection is placed on the pump to help balance the thrust along the shaft and thus relieve the thrust bearing of some of its work. The pressure regulator is not placed in service until the pump is delivering proper pressure to prevent erratic action while the pump is coming up to speed. When the regulator is cut in, the steam line is opened before the water line, to prevent an unbalanced water pressure in the regulator from closing off the steam in the turbine. Usually a cold-water spray line is tapped into the pump suction, the function of which is to admit cold water to the pump when it becomes vapor-bound from pumping hot water. The valve of this spray line should be kept closed except when it is needed, because, when open, the water going to the boiler is undesirable, lowered in temperature and is also not metered. The following instructions for starting and shutting down boiler-feed pumps of the centrifugal type are part of the operating code of the Philadelphia Electric Company, from which they have been abstracted:

STARTING

1. See that the pressure gage on the discharge side of the pump is operating.
2. See that the suction valve is open.
3. See that the discharge valve is open.
4. See that the pressure regulator valves are closed.
5. See that cooling water is on the bearings and seals.
6. Start the turbine or the motor and bring up to working pressure.
7. See that the proper pressure is on the equalizing pipes to balance the thrust.
8. Inspect the oil system.
9. Open the steam-line valve to the pressure regulator.
10. Open the water-line valve to the pressure regulator.
11. Adjust the regulator to give the proper differential between the feed pressure and the steam pressure. In case of running pumps in parallel, the load may be equalized by partially closing the suction and discharge valves on the pumps which are taking the most load.
12. Open the spray-line valve if the pump becomes steam bound.

SHUTTING DOWN

1. Close the spray-line valve, if open.
2. Shut down the turbine or motor.
3. Close the steam-line and water-line valves to the pressure regulator.
4. Shut off the cooling water from the bearings and seals.
5. Close the suction and discharge valves, if the pump is to be dismantled.

Method of Paralleling Phase-Balancer Exciters

WHEN operating two or more phase converters with voltage balancers in parallel, it is also desirable to parallel their exciters and auxiliary exciters, so that the load will be equally divided among the converters. The following instructions have been abstracted from the operating code of the Philadelphia Electric Company and apply in particular to the phase-converter installation at the Schuylkill No. 2 station. Instructions for starting and shutting down phase converters were given in the last issue of the ELECTRICAL WORLD, under "Extracts from an Operating Code, page 1042.

Paralleling phase-balancer exciters and their auxiliary exciters:

1. Close the field switches for No. 1 and No. 2 auxiliary exciters in the "down" position. This is an interlock on the "close" control circuit for the equalizer breakers and the balance-exciter tie breaker.
2. Push the button-type control switch "in" and hold until both red indicating lamps show that the equalizer breakers and the balance-exciter tie breaker have closed.
3. See that all limiting resistance switches are open.
4. Close the two field switches for the auxiliary exciters (mentioned in No. 1) in the "up" position simultaneously. The phase-balancer exciters and their auxiliary exciters are now in parallel.

To "cut apart" phase-balancer exciters and their auxiliary exciters:

1. Pull the button-type control switch "out." The equalizer breakers will open simultaneously as indicated by both green lamps.
2. Either or both of the field switches for the auxiliary exciters may now be closed in the "down" position.

To feed No. 1 phase-balancer field from No. 2 balancer-exciter, or vice versa:

1. Close No. 2 balancer-exciter circuit breaker if starting No. 1 phase balancer, or vice versa.
2. Push the button-type control switch "in." The red lamp should indicate that the balancer-exciter tie breaker is closed.
3. Proceed according to Rules 12 to 17 inclusive of "Phase Converters with Voltage Balancers" (ELECTRICAL WORLD, May 5, page 1042). No. 2 balancer-exciter is now feeding No. 1 phase-balancer field, or vice versa. The interlock is so arranged that only one phase-balancer set can be fed with this connection.

Resuming normal operation, or shutting down with this connection:

1. Close the auxiliary exciter-field switch in the "down" position.
2. Proceed to shut down the phase balancer or to return to the normal method of operating.
3. Pull the button-type control switch "out." The green lamp should indicate that the balancer-exciter tie breaker is open.

What Should Be the Proper Distribution Voltage?

FOUR-WIRE distribution at 4 000 volts is generally favored, and companies that are not now distributing at this voltage are rapidly adopting it, according to the opinions expressed at the recent meetings of the sub-committees of the Technical Section of the Pacific Coast Electrical Association. Greater capacity of existing circuits, better voltage regulation and the fact that 2,300-volt transformers on the lines can be

utilized by connecting between phase wires and neutral are the factors influencing this preference. Some engineers favor one three-phase regulator for four-wire, three-phase, 4,000-volt circuits, while others feel that satisfactory regulation can be obtained with one regulator.

The city of Los Angeles feels that 4,000 volts is not the answer to the city distribution problem and has adopted a 4,800-volt, three-phase, delta-connected system for its distribution, and transformers, regulators and other equipment are being purchased for this voltage. All transformers being purchased are insulated for 7,500 volts to ground so that the system may later be changed over to four-wire star operation if load conditions warrant.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Increased Coal Output by Better Mine Lighting

AS A RESULT of using six times the ordinary strength of illumination (the miners' standard electric lamp) the increase in coal output reached nearly 15 per cent, according to an investigation carried out in a Lancashire (England) coal mine on behalf of the Institute of Industrial Psychology. The more intense light was carried by men who had volunteered for the work. One of these carried the heavier lamp to the coal face during eight weeks with the following results: Average output per man per shift before use of big lamp, 2.47 tons; average output with new lamp, 2.83 tons, or an increase of 0.36 ton. The percentage improvement is 14.57 per cent. These figures refer to two men working together.

Deductions for dirt during the eight weeks' use of the big lamp decreased by 3.5 tons, equivalent to a reduction of 21.87 per cent. The man was now instructed to return to his ordinary lamp, and the following figures were obtained after a further eight weeks: Average output per man per shift during use of big lamp, 2.83 tons; average output per man per shift after use of big lamp, 2.57 tons, or a decrease of 0.26 ton, or 9.2 per cent. Deductions for dirt during this period increased by 5.95 tons, equivalent to an increase of 47.6 per cent.

As the workers in close proximity to these two men had no marked change of output, it seems reasonable to suppose that the cause of the increase was better illumination. It is suggested in the report of the investigation that the weight of the standard lamp might be doubled without proving a serious handicap to the miner. Such bright light would allow a margin of intensity which would permit diffusion of the light by means of a slightly opaque cylinder and thus add to the miners' comfort and powers of vision.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Radio Used to Locate Line Trouble

RADIO communication is destined to play a vitally important part in maintenance of continuity of service on high-tension power transmission lines in the future, in the opinion of operating officials of the Northern States Power Company. This newest form of communication already has been used successfully by the company in quickly locating "trouble" on its lines, and it has proved greatly superior to the wire telephone method previously used.

When the two St. Croix transmission lines tripped out at 1:55 p.m. on Jan. 30 both telephone lines to St. Croix were put out of commission. F. J. Gerlich, superintendent of the service department, lost no time in getting to the radio set and upon tuning in immediately heard the wireless operator at St. Croix calling Minneapolis. By means of radio-telephone communication the trouble on the transmission lines was quickly cleared up, and both lines were back in service by 2:05 p.m. (within ten minutes). Wire telephone communication was not reestablished until half an hour later.

SEVERAL NEW STATIONS TO BE CONSTRUCTED SOON

Radio communication has been established between the St. Croix Falls hydro-electric plant and the Minneapolis office for several months, and a complete transmitting set now is ready for installation at the Coon Rapids hydro-electric station, 17 miles from the Minneapolis headquarters building. Plans are under way for installation of a high-powered station at Mankato, after which stations probably will be installed at Eau Claire, Wis.; Montevideo and Faribault, Minn., and eventually at Sioux Falls, S. D. It is expected to have the station at Eau Claire, and possibly the one at Montevideo, operating before the end of 1923.

The stations at Minneapolis and St. Croix are rated at 100 watts and use five 50-watt tubes—two tubes serving as oscillators, two as modulators and one as a speech amplifier. The circuit which is employed is known as a Colpit-Heising circuit, and the tubes are so arranged that one, two, three or five may be used, depending upon the power required for communication with the desired station. Motor-generator sets, rated at 750 watts and delivering 1,000 volts direct current, are used to deliver the required power to the sets.

These two stations are equipped for both telephone and telegraph communication, although they are designed primarily for the use of the telephone. Both sets are licensed for operation on a wave length of 525 m. and are in charge of licensed commercial operators.

The receiving sets are standard Westinghouse type RC single-circuit receivers. The Minneapolis station is equipped with a loud speaker and power amplifier, making it unnecessary for the operator to wear head telephones while operating the set.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Is Megger Insulation Test Too Exacting?

AFTER an experience with the use of a megger for testing the insulation of a direct-current exciter and its wiring, which was put out of commission by a flood, it is the writer's opinion that the test is too exacting.

After the above accident occurred the exciters tested grounded both with megger and magneto. The armatures were removed and were prepared for a drying-out process with electric heaters, the field windings being subjected to the hot blast from the transformer core drier. The wiring from exciters to switchboard was installed in conduit and was also grounded. After seventy-two hours' drying the exciter armatures tested clear of grounds, but the field coils still showed a ground, although not a serious one. As the accident at this station crippled us considerably, it was decided to put the machines back in operation for a test run without removing the grounds. After a six-hour run the machines were put in operation under full load. After a twelve-hour run a megger test still showed a ground on the ex-

citer, although a test made two weeks thereafter failed to show a ground anywhere in the system. Had we waited until the megger tested clear we believe we should have been delayed for several days more. As you know, a central station man will take a chance to restore service that would be condemned by a factory service man.

S. G. HUNTER,
Operating Manager.
Malone Light & Power Company,
Malone, N. Y.

Grounding Chain Practice Standardized

WITH the purpose of insuring uniform practice in the use of grounding chains by linemen, the Public Service Company of Northern Illinois has issued a set of rules accompanied by a diagram. These orders are the result of considerable experimental work by the testing department of the company to determine the most suitable method of grounding lines.

The instructions describe in detail and by blueprint just how chains are to be applied to the line under various types of construction with and without the overhead ground wire. If properly applied, full and complete protection against accidental energizing of lines from any cause while work is being performed on them is provided in the grounding chains. The instructions to linemen read as follows:

Whenever it is desired to take any transmission line out of service in order to repair or do any work on it, the recognized routine should be complied with. Furthermore:

If the line is reported dead by recognized authority, the party about to do the work will proceed to ground the line. Rubber gloves should always be worn when handling hand lines and chains while the latter are being placed on the transmission line. When the grounding is made by means of chains, the chains must be kept taut or no protection is afforded by them, and the following rules must be observed:

1 *Class A and B single-circuit construction with ground wire, with or without distribution lines on same poles.*

A single length of chain 25 ft. long with a hand line of suitable length, strength and insulation attached to each end appears to be the most suitable for grounding and shorting on these types of line construction. This is to be applied as follows:

One hand line will be thrown over all the wires, including the ground wire, and the chain pulled over these wires to make contact as shown in Fig. 1, a good strain being maintained on the chain and hand lines throughout this procedure. The first-mentioned hand line should then be thrown over the remaining wire and the chain pulled taut as shown in Fig. 2, or pulled into contact with the remaining wire while taut, as shown in Fig. 3. Precaution should be taken to keep the chain away from any distribution lines at any stage of the work. Care must also be taken not to come in contact with the chain or the line conductors until all the conductors and ground are in good contact with each other through the chain.

2. *Lines without ground wire.*

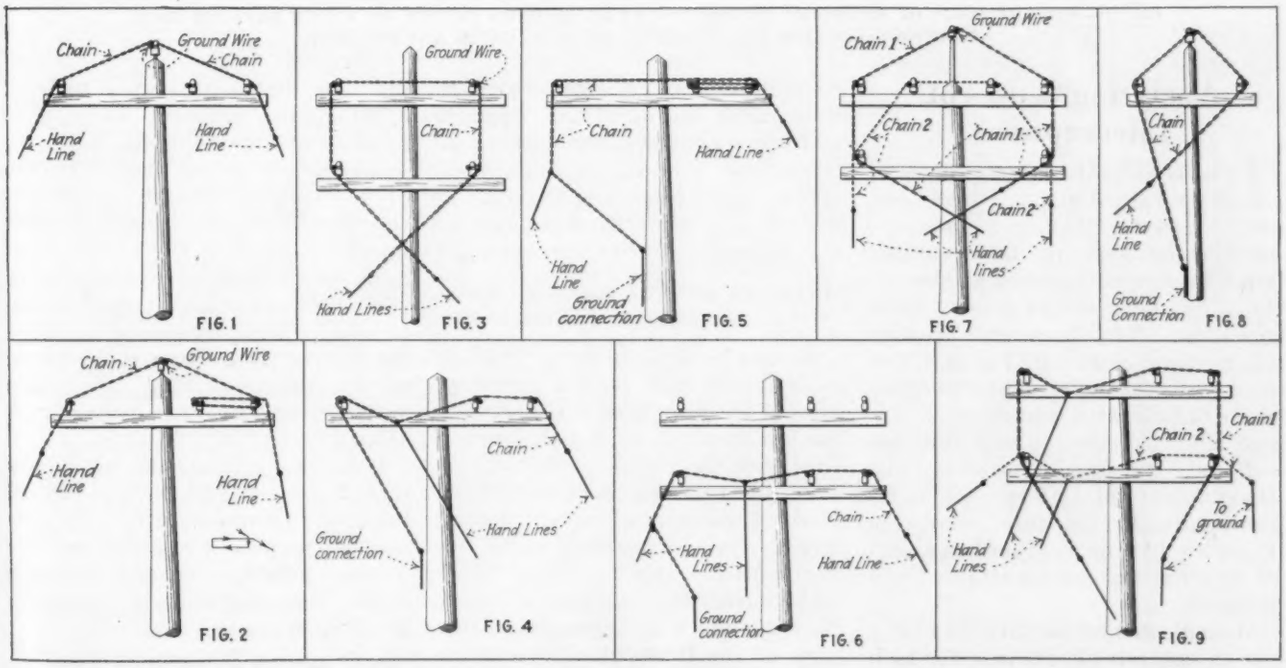
A chain of such length to reach across all conductors and extend to ground will be used. For this purpose a sufficient number of the 25-ft. lengths should be coupled together to furnish the necessary length. One end of this chain is to be clamped to an established ground and a hand line attached to the other end of the chain. The hand line will then be thrown over all the wires and the chain pulled into contact with at least the two outside conductors, as shown in Fig. 4. The hand line will then be thrown over the remaining wire by throwing the hand line up between the two line wires with the wide spacing and the chain pulled taut, as in Fig. 5.

3. *Other types of construction.*

Methods of grounding other types of construction in use in the Public Service Company territory are shown in Figs. 6, 7 and 8. Fig. 7 makes use of two separate grounding chains. If a distribution line is attached to the poles carrying a transmission line upon which it is intended to place a ground, it is necessary that the chain be kept clear of the distribution lines at all times.

When the line conductors are to be parted or are already separated, one chain should be placed on either side of the place where work is being done if there is the remotest possibility of either end of the line becoming energized from any source whatever. After the work is completed, chains must be removed from the line first, before being disconnected from ground, and line cleared and put under orders of the system operator.

ALFRED HERZ,
Engineer of Tests.
Public Service Company of Northern Illinois, Chicago, Ill.



COMPLETE PROTECTION AGAINST ACCIDENTAL ENERGIZING OF LINES AFFORDED BY GROUNDING CHAINS

Various types of line construction used by the Public Service Company of Northern Illinois and the method of using chain to ground each one. All grounding methods shown are started from the left side of the pole excepting chain No. 1 in Fig. 7.

Form No. 1076--2500--8-16--Premier Press

PAGE_____

_____INTERRUPTION RECORD NAME _____

PERIOD_____TO_____ LOCATION_____CAPACITY_____

DATE CUT IN_____ LINE _____

DATE	TIME	Trouble On System	Trouble On Dist. Line	Trouble On Trans. Line	Trouble On Sub-Sta. Eq.	Prearranged For Repairs			Lightning	Insulators	Conductors	Poles-Guys Cross-Arms	Lightning Arrester	H. T. Disc. Switch	H. T. Oil Switch	H. T. Fuse	Power Trans.	Instrument Trans.	Customers Equip.	Operators Mistakes		Unknown	Prearranged For Re-Constr.	REMARKS
		MINUTES							MINUTES															
Total Time																							Total Time Off	
Total No. of Cases																							Total No. of Cases	
Per Cent. Time																								
Per Cent. No. of Cases																								

FIG. 1—PRESENT FORM OF RECORDING INTERRUPTIONS ON ALABAMA SYSTEM, ON WHICH DATA FOR EACH TRANSMISSION LINE ARE CLASSIFIED BY DATE, CAUSE AND DURATION

Analyzing Causes of Interruptions

TO MINIMIZE interruptions of service the Alabama Power Company requires that very accurate records be kept of interruptions, their cause and duration, so that efforts can be made to prevent their repetition. Now the records are kept in the form shown in Fig. 1. This form is considered preferable because it tells at a glance what outage any customer on any line has suffered, its cause, duration, etc. Once a year this information is recapitulated in the form shown in Fig. 2 so that the most serious causes of interruption can be attacked and removed.

As indicated by the form in Fig. 1, now in use, records are kept for each line. Interruptions of service on the whole line are classified by date, time, cause and duration. Opposite each space are places for showing interruptions to individual customers' service, their cause and duration as well as any remarks pertaining to any unusual conditions encountered.

POLES, GUYS AND CROSSARMS MOST VULNERABLE PARTS

As may be seen from Fig. 2, which recapitulates the serious interruptions of the year 1920, the most serious interruptions on the 110,000-volt lines from the viewpoint of duration were due to poles, guys and crossarms. These were extremely unusual cases of trouble, however, as the two interruptions thus ascribed were both caused by a cyclone on April 20, 1920, which destroyed two structures on the Huntsville line and five structures on the Sheffield line, causing lines to go out for a total of 3,720 minutes as noted. In terms of number of interruptions, lightning was the most serious cause. On the 110,000-volt, 44,000-volt and 13,200-volt buses the most serious cause of interruptions from the viewpoint of duration and number was trouble on other sections of the system, as distinguished from trouble on the buses themselves. The same was true on the distribution system. The degree of seriousness of other causes is indicated.

From this analysis and the correction of weakness which it permitted the interruptions have been greatly reduced, because it has been possible to direct attention where it was most needed instead of aimlessly attacking all possible causes.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

INTERRUPTION RECORD

Jan. 1, 1920—Jan. 1, 1921

110-KV. TRANSMISSION LINES

	Trouble on System	Low Frequency	Lightning	Conductors	Insulators	Poles, Guys Crossarms	H. T. Oil Switch	Instrument Transformers	Customers' Equipment	Operators' Mistakes	Accidental	Unknown	Total
Interruptions to													
13-kv.—[illegible]-kv. Lines													
Time	619		957	402½	340½	3720	7			2	6	1085½	13258½
Number of cases	39		130	10	47	2	3			1	2	62	3/4
Per cent Time	4.76		4.91	30.00	24.87	26.80	0.07			0.01	0.04	7.64	
Per cent Number of cases	12.69		41.13	3.16	14.88	0.64	0.95			0.32	0.64	19.60	
Interruptions to													
2-kv.—110-kv. Buses													
8-kv.—44-kv. Buses													
44-kv.—13.2-kv. Buses													
Time	1830	3	35		427		4	88	4		6	25	2407
Number of cases	236	1	13		5		2	4	2		1	4	266
Per cent Time	13.32	0.14	1.45		19.35		0.19	3.98	0.18		0.27	1.13	
Per cent Number of cases	17.02	0.32	4.88		1.87		0.75	1.50	0.75		0.38	1.50	

DISTRIBUTION LINES

	Trouble on System	Low Frequency	Lightning	Insulators	Conductors	Poles, Guys, Crossarms	Lightning Arresters	H. T. Dis. Sw.	H. T. Oil Switch	H. T. Fuse	Power Transformers	Instrument Transformers	Customers' Equipment	Operators' Mistakes	Switch and Testing Trouble	Unknown	Total
Interruptions to																	
22-kv.—44-kv. Distribution lines																	
Time	4181½	375½	1135½	2213	1245	34	119	70	114	87	732	17	8	29	621	488	13725½
Number of cases	480	21	107	67	37	4	5	5	7	6	37	1	4	3	24	16	926
Per cent Time	32.46	2.79	8.80	24.20	10.82	0.25	0.93	0.51	1.06	0.83	6.34	0.13	0.06	0.41	6.10	3.68	
Per cent Number of cases	50.30	2.28	23.18	6.66	3.82	0.42	0.51	0.51	0.72	0.62	3.82	0.11	0.42	0.31	2.47	1.65	

FIG. 2—CLASSIFICATION OF INTERRUPTIONS ACCORDING TO SERIOUSNESS AND CAUSE PERMITS INTELLIGENT CONCENTRATION UPON REMEDIAL MEASURES

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

A Well-Planned Merchandise Salesroom

A Study of Ideas that Have Been Carried Out in the Arrangement of the New Display Room of the Kansas Gas & Electric Company in Wichita

THE Kansas Gas & Electric Company in its new general office and salesroom in Wichita has given a most interesting demonstration of the value of careful planning in a central-station display room. The company's officials believe that an attractive merchandise display not only sells more appliances but raises the standing of the business of the company in the eyes of the public and therefore contributes to the development of energy sales as well.

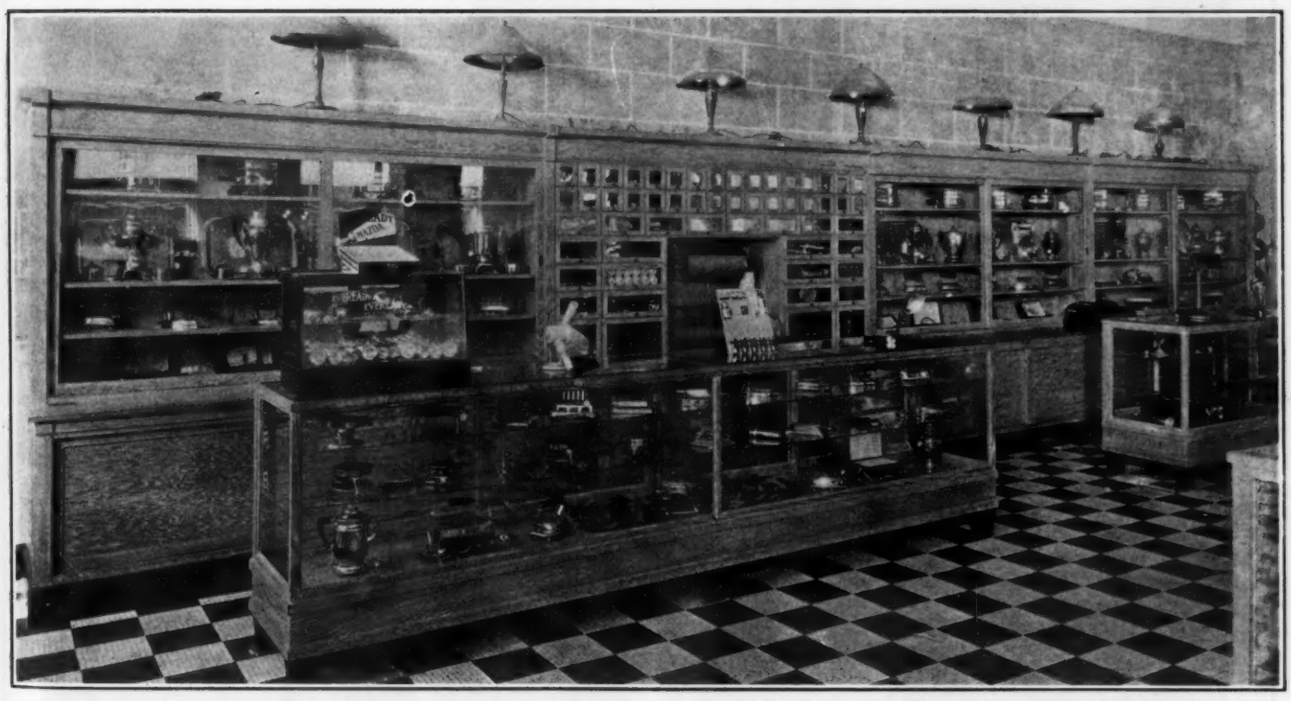
A consumer cannot pass through such a room to the cashier's window or the adjustment window without feeling the effect of the attractive display of merchandise and without gaining a higher respect for the company as a local business concern. Whether it is admitted or not, the feeling of pride in local enterprise is bound to be stirred. All this helps in maintaining public interest and good will for the company.

The primary object, of course, is the sale of merchandise. To accomplish this there is a definitely planned arrangement of the floor space and equipment so that the merchandise can be displayed to the best advantage as the seasons change.

The salesroom in this building, into which the Kansas company has just moved, is the headquarters from which it serves about thirty communities in central and southern Kansas and is an example of the most improved practice in central-station salesroom arrangement. Reference to the illustrations shows that, in place of the usual showcases in the center of the floor, almost the entire floor space has been left clear. The merchandise which is being pushed hardest, either for seasonal or other reasons, is placed in the most prominent positions. The customers' room, where all bills are paid, where troubles are adjusted and other business concerned with the sale of energy is transacted, is at the rear of the merchandise salesroom, and persons visiting the customers' room pass entirely through the display.

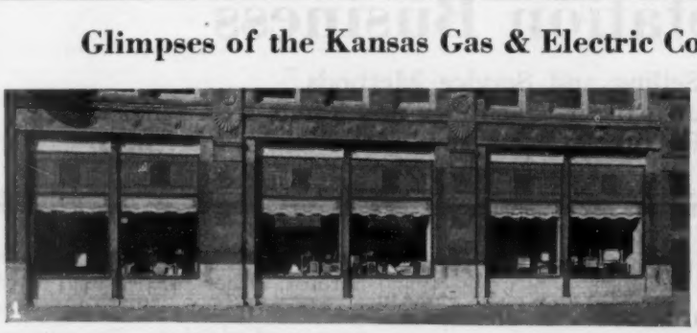
Particular thought has been given to the arrangement of the displays on the floor so that merchandise that requires especial educational or promotional support shall have a strong position and conspicuous display. On studying such merchandise it will be found that certain articles occupy a more staple place in the general demand than does the rest of the stock handled. Every effort is made to give this type of merchandise a prominent and permanent location on the floor so that the volume of sales can be maintained.

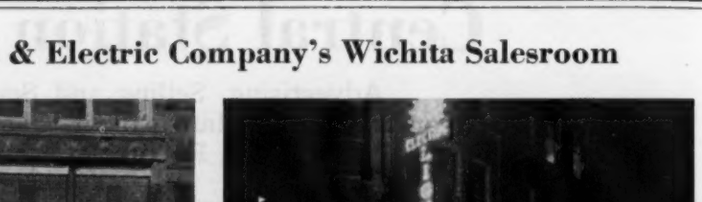
While the center of the floor in the Wichita display room has been

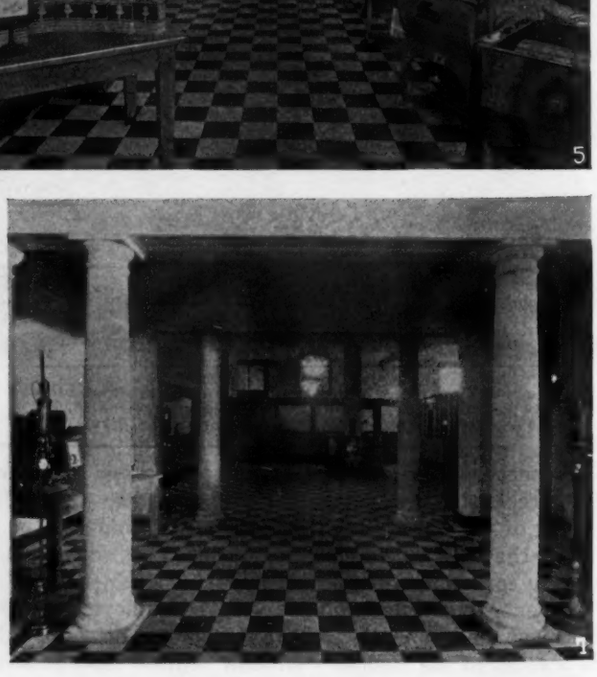


Here is a most ingenious innovation in the electric shop, adopted from hardware practice. Behind the glass counter-case is a display unit largely made up of drawers, each with a display compartment in the front where samples of the device carried inside are shown behind glass. Customers can easily select repair parts.

Glimpses of the Kansas Gas & Electric Company's Wichita Salesroom





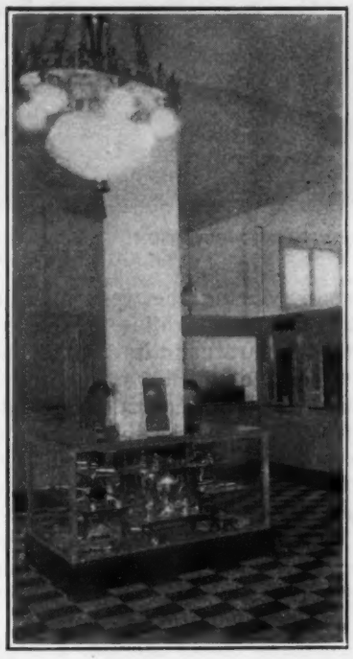


THE most interesting feature of this merchandise display room is the obvious fact that it is planned to promote sales: (1) The show windows are large and line two sides of the building. (2) A bright sign calls from afar. (3) The entrance is in the center on the corner. (4) A three-step, movable display platform presents the most seasonable appliance as the customers enter. (5) One aisle of the display floor, with the lamp counter in the rear, with lamps of all types and sizes connected for demonstration. (6) Another aisle and the main counter where small appliances are displayed and sold. (7) A view through the center of the salesroom, with the "customers' room," where bills are paid, in the rear.

left clear for the larger articles and the counters apparently occupy a secondary position in order to make the handling of merchandise displays more flexible, this lack of the usual large central counters has been compensated for by placing small counters for appliance display around four of the square columns that support the upper floors. This does not interfere with the use of the floor space for the heavier displays. The main counter has been placed at the extreme left side of the room, away from the main entrance, but convenient to any one coming in from the building hallway and passing on to elevator and building stairway.

Another idea in the arrangement of counters is the placing around one of the square building columns in the customers' room of a glass-top counter which serves the purpose of a writing desk and at the same time permits the display of one specimen of virtually every type of smaller appliance sold in the store, in direct view of the customer who may be writing a check or a memorandum.

Perhaps the most attractive element in the entire salesroom is the display equipment itself, which has been developed to an unusual degree. Back of the main counter, for instance, is a set of glass-inclosed shelves for small appliance display. On the same level is a section of drawers which contain the small devices and other repair parts that customers are apt to call for. The front of each drawer is glass, and a partition is set just back of the glass panel to form a narrow compartment into which one or two samples of the articles carried in the drawer can be placed, so that they can be seen through the glass panel. This enables the customer, who may not have the slightest idea as to the name of the repair parts he wants, to select them by sight. This display case is adapted from hardware-store practice. Underneath these display shelves and drawers is a row of large drawers for stock in storage,



GLASS DISPLAY COUNTERS SURROUND THE PILLARS NEAR THE CASHIER'S WINDOW AND ARE USED AS WRITING DESKS

and practically all this stock on hand is kept in the display room, where it it is readily accessible.

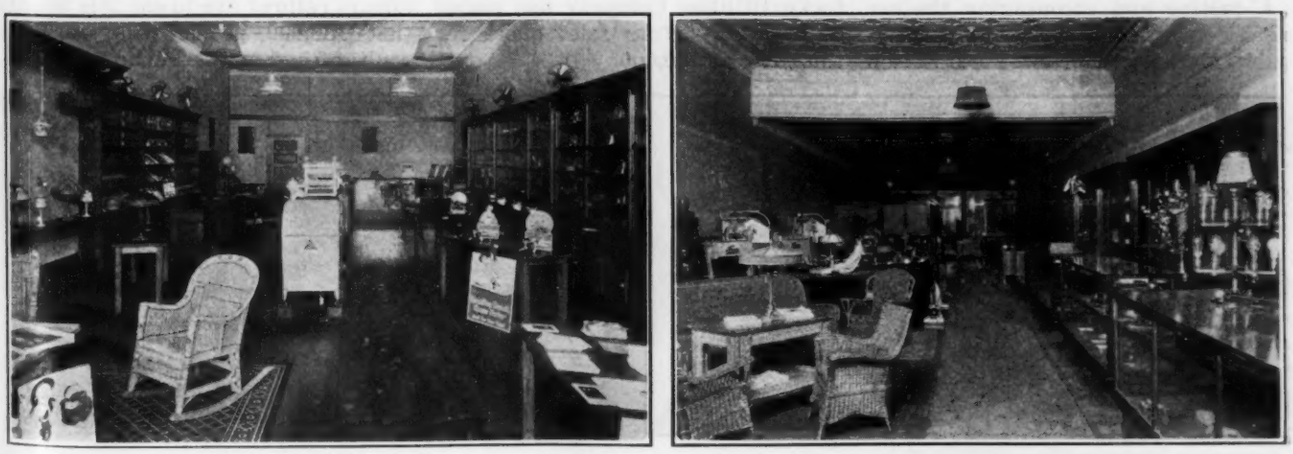
There is a lamp-sales counter at the rear of the salesroom directly back from the main entrance and in the aisle through which most of those on their way to the customers' room pass. As will be seen in the illustration, a number of lamps are mounted in a row at the front of an opening into the case well above the level line of vision. This opening is finished with black inside as a background, and on the counter directly in front of the customer are a number of flush switches corresponding in number and position with the lamps. A sample of each kind of lamp is connected with the sockets, and the customer is aided in making a quick selection by turning on the light.

Another feature which has been adopted from the hardware store is a stepped platform on which the medium-sized appliances are displayed. For example, electric or gas heaters occupy this space during cold weather, and electric fans will be placed on the same device when the hot weather comes on. The banked platform consists of three steps, rectangular in form, and is mounted on castors so that it can be moved.

Space has been provided for the demonstration of either electric or gas ranges in the rear of the room. It is proposed to use this not only in connection with demonstrations put on by the company but in connection with the work of the domestic science department of the public schools.

Naturally a considerable amount of small repair work is brought into the salesroom, and experience has shown that the plan of receiving this work in the office and then sending it out to a repair department some distance away is not satisfactory, because many of the repairs are the work of a few moments only and the customer would like to wait for their completion. A small room to the rear of the main display room has therefore been provided for small repair work brought into the office. In this way all small repair work is kept within reach of the display room.

The Kansas Gas & Electric Company operates branch salesrooms in a number of smaller communities, and,



BRANCH OFFICE SALESROOMS AT CHERRYVALE AND ARKANSAS CITY, SHOWING TYPICAL ARRANGEMENT USED IN SMALLER CITIES

SALESROOM AT MOLINE, A TOWN OF 1,000 POPULATION

of course, these stores do not offer the same chance for planning and arrangement that is offered in the spacious new quarters in Wichita. However, the same principles are carried out so far as possible and no possible effort is spared to make them attractive. The picture of the rooms at Moline (1,000 population), Cherryvale (5,000) and Arkansas City (11,500) show how these ideas are carried out. One thing that should be noted especially is the way in which the small staple items are arranged. The counter with the triangular-shaped top in the picture of the Cherryvale office is the clearest illustration. This contains a variety of small staple articles and is placed so that it is close to the point at which the customer pays his bills. With his change in hand his inclination is often to buy an inexpensive article, and the arrangement of these counters has been found very stimulating to sales.

New York Edison Exhibits Electro-Medical Apparatus

FOLLOWING its policy of promoting and encouraging the use of electrical energy in every conceivable manner, the New York Edison Company during the week of April 23-28 held an exhibit of electro-medical apparatus in its Irving Place showroom, to which were invited all members of the medical and dental profession. The leading manufacturers of apparatus exhibited, their displays including everything from diagnostic lamps and sterilizers to the most elaborate X-ray equipment. The exhibit was held under the auspices of the Bureau of Electro-Therapeutics of the Edison Company, of which Miss Mabel Martin, a registered nurse, is manager.

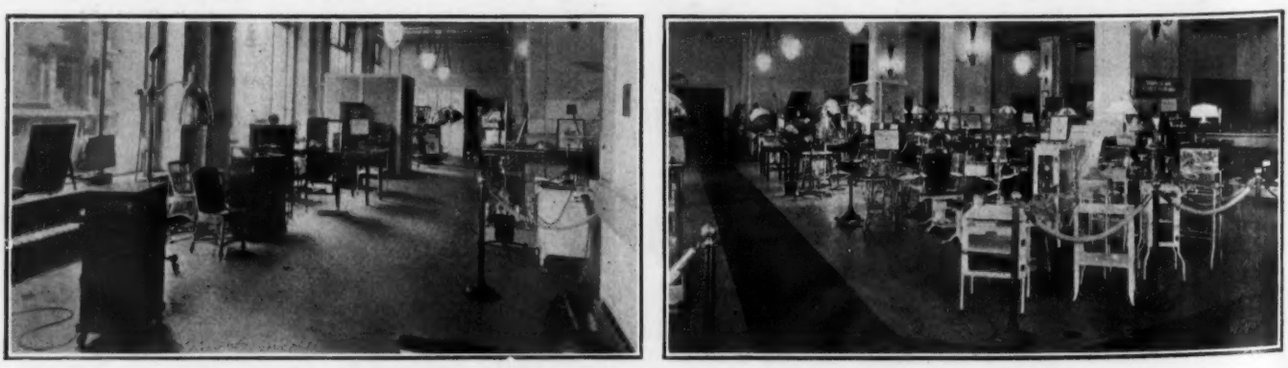
What Other Companies Are Doing

Louisville, Ky.—For some time the Kentucky Utilities Company has sold lighting fixtures under an agreement with the manufacturer by which fixtures were furnished on consignment. This business has been very successful, and a new contract provides, in addition to the consignment arrangement, for a fixture salesman to be furnished at the manufacturer's expense. In view of this additional co-operation, the Kentucky Utilities Company has placed its lighting fixture sales quota for this year at $50,000.

Berlin, Wis. — The Wisconsin Power, Light & Heat Company has made a definite step toward helping merchants to improve the appearance of the business district at night by reducing the rates for window and display lighting to about half the former rate. The proposal of the electric company follows a period of agitation by business men for a uniform and modern system of store-front illumination. The feeling has been crystallizing for some time that individuals and community alike would benefit by an improvement in the store-window and sign lighting of individual business houses. The policy of the company is to help advertise the community in which it is located, and it is the pursuance of this policy that prompted the company to offer a minimum charge of $1 per month and an energy charge of 7 cents gross and 6 cents net per kilowatt-hour for all window and display lighting. H. R. Smith is district superintendent of the company.

Boston, Mass. — Eight electric companies under the management of Charles H. Tenney & Company added to their lines 5,273 newly wired old houses during 1922, the total number of outlets involved being 82,834. The cost of this wiring was $551,798, or $6.66 per outlet. The work was financed by various plans, including loans by local banks, central-station credit, contractor-dealer credit and the Morris plan.

Los Angeles, Cal.—Plans of the commercial department of the Southern California Edison Company call for the connection during the year of thirty thousand new homes which will use Edison service. This does not include the many thousands of new consumers taking service from distributors who buy service from the company wholesale. On the customary ratio of five to one this means that 150,000 people will join the ranks of consumers in one year.



ELE TRO-THERAPEUTIC EQUIPMENT ON DISPLAY IN NEW YORK EDISON SHOWROOM

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Rebuilding of Boiler Plant Reduces Coal Consumption More Than One-Half.—A modern boiler plant containing six water-tube boilers varying in size from 4,000 sq.ft. to 5,000 sq.ft. of heating surface was built on the site of an old overloaded plant containing fifteen boilers, without interruption to service. It was found that eight of the old boilers were in good condition, and these were rebuilt and enlarged by placing another deck of tubes below the old ones and connecting the headers by short nipples. Purchasing two new boilers made ten available, six of which have been installed, and room has been left in the plant for the installation of the remainder when they are needed.—*Power*, April 10, 1923.

Interior Treatment of Boiler-Feed Water.—A. J. LOPPIN.—Though it is generally best to treat hard make-up water before it is sent to the boilers, special conditions may warrant the use of treatment within the boiler. Whether the exterior or interior treatment should be used depends upon the conditions prevailing at the plant under consideration. It depends upon the amount and kind of scale-forming ingredients in the water, the amount of make-up, water used, the course of the water from its source to the boiler, the period of operation of the boiler, the use of the steam, comparative first cost and maintenance cost for each system, type of boiler, rate of evaporation, pressure, load maintained, etc. The effect of each one of these factors on the final selection is considered.—*Power*, April 3, 1923.

Generation, Control, Switching and Protection

Differential Relay for Protection of Three-Phase System.—R. J. JENSEN.—The author describes a system of relays designed by himself for the new power station in Copenhagen. The fundamental feature of the new relay is that the unbalance itself, and not the entire load, is used to actuate the relay. This gives uniform sensitiveness for all conditions of load. The two phases to be controlled are carried into the primary windings of a transformer. To one of these primary circuits are added a resistance and an inductance which are dimensioned so that the current in this phase is displaced 60 deg. with reference to the other phase. The secondary winding is connected to the relay. The voltage induced in this winding is dependent only on the unbalance between the two phases since the balanced parts are neutralized.—*Teknisk Tidsskrift*, Jan. 24, 1923.

Magnetomotive Forces Produced by Single-Phase and Polyphase Windings.—R. D. ARCHIBALD.—A description is given of a simple method of showing the variation in magnetomotive force of a single-phase alternator winding by the shadow of a vane attached to a rotating spindle. The application of the same principle to the case of polyphase windings and the method of arriving at the position and dimensions of the vanes are explained. An apparatus is described which is arranged to show the magnetomotive force produced in the air gap of an induction motor by the stator and rotor windings under load conditions, with the rotor either stalled or revolving.—*Journal of Institution of (British) Electrical Engineers*, March, 1923.

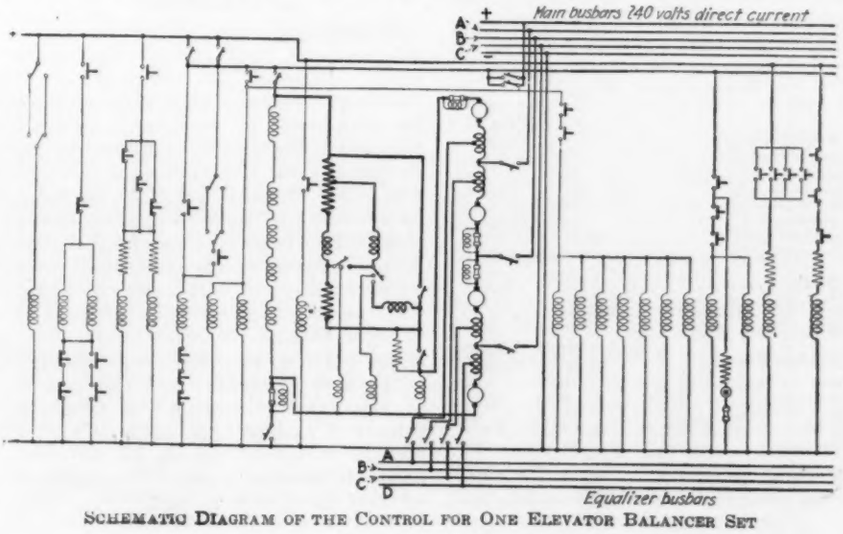
Transmission, Substations and Distribution

Automatic Balancer Substation for Elevator Service.—M. A. WHITING.—In the multivoltage system power is supplied to the elevators from five main buses (see accompanying diagram) which provide four accelerating steps for the elevator motors of 60 volts per step. Voltages for the four-step buses are individually supplied by the four units of the balancer sets acting cumulatively in turn. Considering the acceleration of one motor only, on the first step, say the motor is connected from the plus to the A bus, then one unit of the balancer is supplying 60 volts to the multivoltage bus, and the three others are motoring. On the second step the elevator motor would be connected from the plus to the B bus. Under this condition two units are in series, generating 120 volts, and two are motoring. On the third step three units in series are generating 180 volts and one is running as a motor. When full elevator speed is reached the elevator motor is supplied directly by the 240-volt bus. When this condition obtains the balancers float across the line idle unless the current becomes unbalanced for any cause, in which case the set will make up the discrepancy. This arrangement takes care of the service while imposing the least practical load on the balancers.—*Power*, March 27, 1923.

Grounding Cable on Overhead Lines.—H. BEHREND.—Investigations of the author on experiences with a grounding cable over an overhead line on systems of 50,000 volts or more indicate that the protective value claimed for such a cable is being considerably overestimated. In case of a ground on the line through a steel tower the danger of a high potential on this one tower is greatly diminished by a cable connecting all the towers. But this, the author claims, is the only positive advantage of a grounding cable, and it could be accomplished far better by laying out a bare underground cable connected to every one of the towers. The cost of the usual overhead grounding cable is about 10 per cent of the cost of the transmission line, an amount which is entirely too high to be paid just for the purpose of diminishing the ground resistance.—*Elektrotechnische Zeitschrift*, March 22, 1923.

Units, Measurements and Instruments

Tests on Oil Switches.—G. BRÜHLMANN.—In several large power stations where up to 32,000 kva. of energy was available short-circuit tests were made on oil switches and their performance was studied. The paper contains a very detailed report of these tests, including several oscillograms. The tests comprised investigations of the influence of multiple breaks, the generated gas pressure and the duration of the arc under oil. The tests seem to indicate that a division of the rupturing arc into a number of smaller arcs lessens the difficulties of the opening process, but that this benefit is not so pronounced in low-voltage switches as it is in types for very high voltages. A switch with as many as fourteen breaks



SCHEMATIC DIAGRAM OF THE CONTROL FOR ONE ELEVATOR BALANCER SET

per phase was tested and compared with one of only four breaks per phase. With three and one-half times as many contacts the duration of the rupturing arc was reduced only one-half, the sum of the arc lengths increased 25 per cent and the gas pressure generated rose from 4 atmospheres to 6 atmospheres. The excess cost of such a large number of contacts is therefore not warranted. Of considerable interest are tests made on a 35,000-volt oil switch with energy for the test delivered from a specially designed 12,000-kva. steam turbo-generator. Reaching a crest value of about 25,000 amp. short-circuit current, it was found from the oscillograms taken that the switch contacts opened and closed again three times before the intended opening. This was attributed to a lifting of the contacts due to the large dynamic forces acting upon them, and it resulted in a redesign of the contacts. A locomotive switch designed for 16⅔ cycles and 15,000 volts was tested with 16,000 volts and 3,250 amp., which would correspond to a three-phase rupturing capacity of 155,000 kva. After clearing the short circuit eight times at intervals of four minutes and one minute the breaker remained in perfect condition, it being the only breaker of several submitted for test by different manufacturers to stand up under the test. As a result the Federal Swiss Railways selected this type of switch as the standard equipment for its electric locomotives. The article contains a number of interesting photographs of modern Swiss oil switches designed for voltages up to 150,000. — *Brown-Boveri Mitteilungen*, April, 1923.

Motors and Control

Application of Electricity to the Printing Industry. — Printing machinery is now almost exclusively driven by electric motors, and as a direct result of this development control apparatus has been highly developed. Raised-surface or typographic printing is the particular field covered in the article. This includes newspaper printing, magazine printing and the vast amount of work done by book and job publishing houses. The article pertains to the printing industry in Canada.—*Electrical News*, April 1, 1923.

SOURCES OF POWER FOR THE PRINTING INDUSTRY IN CANADA

Newspapers and Periodicals

Kinds of Power	Number of Units	Hp. Actually Employed
Steam engines	9	662
Gas engines	25	80
Gasoline engines	256	517
Waterwheels	14	33
Water motors	28	55
Electric motors	2,665	8,998
Other power	140	734
Totals	3,137	11,079

Printing and Bookbinding

Kinds of Power	Number of Units	Hp. Actually Employed
Steam engines	1	17
Gas engines	4	12
Gasoline engines	16	60
Electric motors	2,457	5,362
Other power	21	20
Totals	2,499	5,471

Speed Control of Polyphase Motors. —GORDON FOX. — An exhaustive and complete analysis of the factors involved in the operation of this type of motor is given. A classification of various systems of control and a description of each system are included. Three methods of speed control function through change of synchronous speed. These are the variable-frequency system, the multispeed motor and the cascade set. Three common control methods depending upon variation of the amount of slip are secondary resistance or rheostatic control, primary voltage control and dynamic control. Under "dynamic control" fall the Kramer, Scherbius and frequency-converter systems.—*Blast Furnace and Steel Plant*, March, 1923.

Heat Applications and Material Handling

Recent Developments in the Arc-Welding Field.—W. L. WARNER.—This is the annual report on electric arc welding presented before the American Welding Society at the annual meeting on April 25. The paper includes standard tests for welds, welding wire specifications, arc welding of cast iron, welding oil storage tanks, rail joints and various other applications, welding monel metals, manufacture of pure iron, arc-welding apparatus and suggested research activities.—*Journal of American Welding Society*, April, 1923.

Methods of Handling Materials in the Electric Furnace and the Best Type of Furnace to Use.—F. E. BROOKE.—The author discusses the design of various electric furnaces, such as the plain box type, the special box type, the car type, the recuperative and continuous furnaces, and refers to their advantages and disadvantages. Attention is drawn to the method of handling materials for these furnaces so that a uniform temperature and high furnace efficiency may be maintained.—*Paper presented before the American Electrochemical Society, New York*, May 3-5, 1923.

Illumination

Influence of Paint on Interior Illumination.—R. L. HALLETT.—This paper briefly discusses the illumination of building interiors, particularly from the standpoint of secondary illumination or the illumination obtained by reflection of light from walls and ceilings. The effect of color and surface finish on reflection of light is discussed, and information is given concerning the reflection properties of paint made with various materials. Durability of paint films as affecting reflection of light is referred to, and the effect of the opacity of pigment as influencing reflection of light is brought out. The results of experiments showing the reflection factors of various kinds of paint and of the durability of paints of different composition are given.—*Transactions of the I. E. S.*, April, 1923.

Electrophysics, Electrochemistry and Batteries

Influence of the Base Metal on the Structure of Electrodeposits. — W. BLUM and H. S. RAWDON.—If copper is deposited electrolytically upon cast or rolled copper which has been cleaned with alkali, the structure of the base metal does not apparently affect that of the electrodeposit. If, however, the surface of the base metal has also been treated with nitric acid, the electrodeposited copper possesses both the crystal form and the orientation of the base metal.—*Paper presented before the American Electrochemical Society, New York*, May 3-5, 1923.

Telegraphy, Telephony, Radio and Signals

Magnetic Shunts in Telephone Receivers.—H. CARSTEN.—The influence of a magnetic shunt across the pole pieces of the permanent magnet in a telephone receiver upon the sensitiveness of the telephone is investigated by experiments and calculation. It is found that the effect of the magnetic shunt depends largely upon the density of the field of the permanent magnet. An actual increase of sensitiveness can be obtained only with very high magnetic flux densities, for which the generally used magnets are insufficient. It is claimed that the addition of a shunt to magnets used today in modern telephone factories has therefore no advantage. — *Elektrotechnische Zeitschrift*, March 22, 1923.

Tuned Radio-Frequency Amplification with Neutralization of Capacity Coupling.—L. A. HAZELTINE.—Tuned radio-frequency amplification is based on the general principle that electrostatic or capacity coupling between two circuits behaves like electromagnetic coupling in that it may be reversed and may be reduced to zero. This is accomplished by balancing one capacity against another. To attain the balance condition it is generally necessary to reverse the phase of a voltage, and this involves the use of a transformer in addition to the capacities. The circuit is a simplification of previous circuits and not an elaboration. It eliminates a previously existing disturbing feature and so gives pure relay amplification. —*Q.S.T.*, April, 1923.

Miscellaneous

Newer Aspects of Ionization Problems.—H. S. TAYLOR.—A résumé is presented of some recent work by Born, Fajans, Haber and others on the problem of energy changes accompanying the conversion of some solid crystalline substances and of the hydrogen halides into dissolved ions. An outline is given of the concepts of lattice energy and of the electron affinity of halogens, the quantitative side of the problem receiving detailed consideration. Small modifications of the earlier calculations have been made whenever newer material of a more reliable nature seemed to be available.—*Paper presented before the American Electrochemical Society, New York*, May 3-5, 1923.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

English and Engineering

A Volume of Essays for English Classes in Engineering Schools. Edited by Frank Aydelotte, president of Swarthmore College. Second edition. New York: McGraw-Hill Book Company, Inc.

The function of English in technical education is, as President Aydelotte points out in his admirable introduction, twofold—"in the first place, to train students to express themselves in writing and speaking, not merely grammatically, but with order, force, sincerity and such charm as their natures will allow; in the second, to furnish something of the liberal, humanizing and broadening element which is more and more felt to be a necessary part of an engineering education." The two aims, the writer continues, are in reality closely connected and by them the outline and arrangement of his anthology have been dictated. The range from which material has been drawn, already a wide one in the first edition of six years ago, has been made even wider, embracing writings which extend from the works of John Ruskin, John Stuart Mill and Robert Louis Stevenson to those of living engineers and the advertisements of manufacturing companies. The book is divided into six parts, under each of which from two to nine essays or discourses are grouped without comment or notes. The first section, entitled "Writing and Thinking," is "an attempt to make the student see the dependence of writing on thinking, to impress upon him the first of all principles of good writing, that he must have something to say." The second and third sections deal with the profession of engineering and the demands which it makes on the engineering schools. The titles, "Pure Science and Applied," "Science and Literature" and "Literature and Life," epitomize the scope of the remaining sections.

President Aydelotte's collection, even though many refulgent masters of prose are necessarily unrepresented, is abundantly adapted to the classroom study of the engineering pupil who has heard and practiced correct speech from early childhood, who has an innate love of literature and who can feel the charm of words and delight in their nice uses and distinctions. Unfortunately, such students are comparatively few in our technical schools. Has the editor of this volume, one wonders, a plan by which the large majority of engineering undergraduates—boys of deficient elementary education, from homes where letters are little cultivated, who have turned to engineering just because they do *not* care for books or writing, but do love to use their hands and their wits in practical and productive arts—can be taught, not to compose treatises in masterly English, but, when occasion arises, to tell a plain, unvarnished tale of facts and experience in a clear, concise and grammatically correct manner? Will there come a day when a technical graduate as profoundly ignorant of rhetoric and as slovenly in syntax as hundreds of them are today will be as much a source of amazement as one ignorant of higher algebra or the use of logarithms?

Die Technik der Elektrischen Messgerate

By Dr. George Keinath. Munich and Berlin: R. Oldenbourg. 448 pages, 372 illustrations.

Many authors keep abreast with the rapidly advancing art of instrument building by the frequent issue of new editions, so that there is really no lack of complete and up-to-date books on this subject. But all of them have one shortcoming in common in that they either surround a purely technical description of the construction of the instruments with too much theoretical matter, or else they neglect the constructive part of the instruments altogether. Dr. Keinath has written a book for the practical engineer and has introduced only such theoretical and mathematical explanations as are essential. The chapters on registering and "hot-wire" instruments contain details and test results found nowhere else in electrical literature. The author is connected with the Siemens & Halske company, which accounts for the fact that instruments and design of this firm are mentioned more frequently than others. By adding fifteen or twenty pages of details on the existing designs or oscillographs and apparatus for the measurement of the magnetic properties of iron the book could be made complete. A. PALME.

The Essentials of Transformer Practice

By Emerson G. Reed. New York: D. Van Nostrand Company. 257 pages, illustrated.

A thoroughly readable and thoughtfully prepared treatment of the theory, operation and design of transformers. While meant primarily for the student and operating engineer, the treatment is fundamental and adequate for the specialist and designer. Much original material on transformer iron and insulation is contained in the text, the discussion of transformer heating being particularly good. The design element is subordinated to the fundamental physical phenomena and the use of mathematics is reduced to a minimum. General relations, polarity, reactors, losses, efficiency, transformations and regulation are discussed with a splendid perspective. The make-up, style and material combine to make this book a noteworthy addition to transformer literature.

Advanced Laboratory Practice in Electricity and Magnetism

By E. M. Terry. New York: McGraw-Hill Book Company, Inc. 258 pages, illustrated.

A course in electrical measurements is given to electrical students in many schools, and for such courses this book of Dr. Terry is admirably adapted. It contains a carefully selected amount of material which is presented in teachable form. It recognizes the changes in the electrical art by adding to the usual measurements carefully prepared chapters on the discharge of electricity through gases, radio activity and thermionics. The fundamental principles of transient phenomena are treated in some detail. The arrangement of the book is good and well adapted to the laboratory method of teaching. Much of the material is new, and the work should be well received by the colleges and prove interesting to many engineers engaged in measurement work.

Electric Toy Making

By T. O'Conor Sloane. New York: Norman W. Henley Publishing Company. 249 pages, illustrated.

Practically every type of amateur application of electricity is treated in the twenty-first edition of this book. It is the type of book that boys delight in having and has some very useful designs for more mature students.

Books Received

The Induction Voltage Regulator. By E. F. Gehrkens. Schenectady, N. Y.: The General Electric Company. 516 pages, illustrated.

Aide-Memoire et Schemas de l'Entrepreneur-Electricien. By P. Maurer. Paris: Dunod. 620 pages, illustrated.

Synthetic Resins and Their Plastics. By Carleton Ellis. New York: The Chemical Catalog Company, Inc. 514 pages, illustrated.

The "Electrician" Electrical Trades Directory and Handbook of the Electrical Engineering and Allied Trades, 1923. Forty-first edition. London: Benn Brothers, Ltd. 1,364 pages.

The Essentials of Transformer Practice. By Emerson G. Reed. New York: D. Van Nostrand Company. 265 pages, illustrated.

Advanced Laboratory Practice in Electricity and Magnetism. By Earle Melvin Terry. New York: McGraw-Hill Book Company. 261 pages, illustrated.

Business Cycles and Unemployment. Report and recommendations of a committee of the President's Conference on Unemployment, including an investigation made under the auspices of the National Bureau of Economic Research. New York: McGraw-Hill Book Company. 405 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Engineer in Public Affairs

Four Founder Societies in New York Hear Discussion of the Part He Should Play

A MEETING under the auspices of the four founder societies of the United Engineering Society was held in the Engineering Societies Building, New York City, on Tuesday of this week to discuss "The Engineer in Public Affairs." Senator Stirling of South Dakota, who was to have made an address, was unavoidably absent. Gano Dunn, president of the J. G. White Engineering Corporation, who occupied the chair, declared that the engineer must be an all-around man before he can reach the heights of his profession. The increasingly essential relation of engineering works and structures, engineering operations, engineering conceptions and even engineering terms and habits to the daily life of the people of the United States has been so marked, he said, that engineering of itself has been taking a greater and greater part in public affairs, and if the engineer cannot keep pace with his subject, then certainly he is unworthy of the name. At the same time, Mr. Dunn recognized the possibility of overemphasizing the desirability of direct participation by engineers in public affairs. The proper line of demarcation was one of the things for consideration.

Admiral John K. Robison, engineer-in-chief of the United States Navy, told of engineering in the navy and made a strong plea for that branch of the nation's defense. The navy's problems, he said, are largely engineering ones.

President Frank B. Jewett of the American Institute of Electrical Engineers took Senator Stirling's place on the program and urged, as did Mr. Dunn, that all engineering bodies unite in support of the Federated American Engineering Societies, burying their individual points of view where these conflict.

New York Legislature Passes Ferris Amendment

Before adjournment last week the New York State Legislature passed for the second time the Ferris amendment to the state constitution, referred to last week, which authorizes the use of not to exceed 3 per cent of the lands of the forest preserve for the building of transmission lines and the erection of power and generating stations for electrical development of state-owned water powers. The amendment will go to the people for ratification at the general election in November.

Five amendments to the Public Service Commission law were passed and are now in the Governor's hands. Two of these affect gas companies, one of them restoring "dollar gas" in New York City; two affect steam and electric railway companies, one of them ordering all steam tracks within New York City to be electrified by January, 1926, and the fifth amends sections of the law relative to the verification and filing of annual utility reports.

Public Service of New Jersey Places Big Orders

Orders have been placed by the Public Service Corporation of New Jersey for the initial installation of 200,000 hp. for its new steam station at Kearney, N. J. The General Electric Company is to build three 40,000-kva. units for this plant, and the Westinghouse Electric & Manufacturing Company two units of the same rating. Ultimately ten units will be installed, giving the station a rating of 400,000 hp. Stoker-fired boilers will be used.

Annual Business Meeting of A. I. E. E.

The annual business meeting of the American Institute of Electrical Engineers will be held at the Engineering Societies Building, New York, next Friday, May 18, at 4 p.m. Results of the annual election of officers will be announced and the report of the board of directors presented.

Ford May Develop Many Michigan Power Sites

A bill permitting private corporations to condemn 25 per cent of the land necessary to develop water-power sites was passed by the State Legislature of Michigan last week and was reported to be likely to receive the Governor's signature and become law. Its passage may lead to development of water-power sites all over the state by Henry Ford. The Ford interests, it is said, exerted all the pressure at their disposal to get the bill through.

The bill as it passed the House carried an amendment introduced at the request of Governor Groesbeck which stipulates that the state shall retain title to all lands condemned and lease them to private corporations.

Southern Power Halts Work

Immediate Construction of Catawba River Project Abandoned—High Costs the Obstacle

AS FORESHADOWED in the ELECTRICAL WORLD for April 28, page 995, the Southern Power Company has definitely abandoned its expansion program, for the present at least, on account of increased costs of labor and electrical equipment. Announcement to that effect was made at Charlotte, N. C., last Saturday by J. B. Duke, president of the company, who said that the company found it impossible to build at today's costs and earn a reasonable return at the rates allowed. For several weeks officials and engineers of the company have been going over building plans and consulting with equipment manufacturing concerns and contractors. Three weeks ago it was semi-officially announced that prices were so high that it seemed highly probable that the company would have to halt its building program. Further conferences only confirmed previous ones as to costs, and the definite announcement of abandonment of the program was made.

WILL COMPLETE PROJECTS UNDER WAY

Following a period of inactivity during and immediately after the war, the power company last year began building again. Two large projects were started, one at Great Falls, S. C., developing 60,000 hp., and one at Mountain Island, N. C., developing 80,000 hp. The Great Falls plant is now complete and the Mountain Island plant will be completed this year. In addition to this hydro-electric construction, work was begun on two steam auxiliary plants, one of 40,000 hp. at Mount Holly, N. C., and one of 20,000 hp. at Eno, N. C. Work was also begun on 200 miles of transmission lines. This work will all be completed this year. As already announced in these columns, it was the purpose of the company to begin work on at least one more plant, and a site on the Catawba River, near Rhodhiss, N. C., was selected. The plans called for the development of 50,000 hp., and had a halt not been called this power would have been ready for industrial use by early next fall and would have taken care of present accumulated demands on the company, amounting to about 25,000 hp., and provided a surplus for future demands.

Rates in North Carolina are fixed by the State Corporation Commission. The present power rates were fixed three years ago and were based, it is

said, on original costs of the plants existing at that time. These plants were built when everything was much cheaper than now and were also built at the best sites; that is, where power could be developed at the least cost.

In addition to the increased labor and equipment costs, another item of expense to the company which, it is maintained, has more than tripled in the last few years is land, which the company has to acquire by the thousands of acres adjacent to and above its dams.

Byllesby Acquires Oklahoma Utilities

Thirteen towns and cities in Oklahoma, with a combined population of 50,000, were added to the lines of the Oklahoma Gas & Electric Company this week upon the absorption by the H. M. Byllesby Company, Chicago, of the Shawnee Gas & Electric Company, the Oklahoma Light & Power Company, supplying electricity in Ada, Sulphur, Paul's Valley, Holdenville, Seminole, Maud, Harjo, Konawa, Francis, Roff and Maysville, and the Southern Oklahoma Power Company, which has a steam turbine station at Byng rated at 8,000 hp.

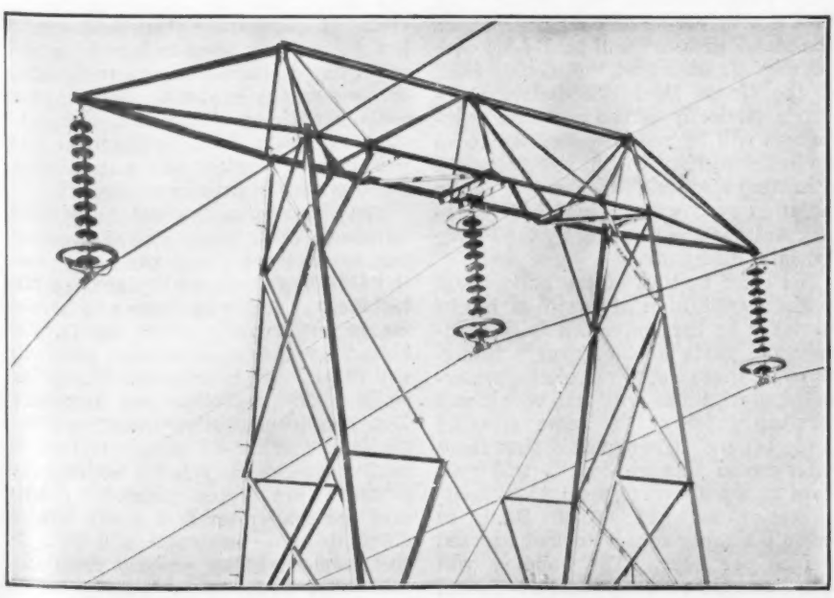
Most of these communities are interconnected by 123 miles of transmission lines, with 30 miles of new lines under construction. Eventually these properties may be connected with the 400-mile transmission system of the Oklahoma Gas & Electric Company, which now serves forty-nine cities and towns with a population of 277,000. The newly acquired properties serve 7,489 electric customers.

Transmission at 220,000 Volts a Fact

Big Creek Line Was Synchronized with Southern California Edison System Early Last Sunday Morning—A Triumph of Years of Research—No Hitch of Any Kind Is Experienced

AT 6:12 O'CLOCK on the morning of May 6, 1923, the switches on the Big Creek lines of the Southern California Edison Company were closed and 220,000-volt transmission became an accomplished fact. Reports from California say that everything came off according to schedule with no hitch. The event marks the culmination of years of research, experiment and study of the problems of higher-voltage transmission by some of the most prominent electrical engineers in the profession, and to the electrical industry and the scientific world the day will go down in the annals of electrical progress as one of the important dates.

The photograph represents a suspension tower on one of the Big Creek transmission lines. These lines have been operating for some time at 150,000 volts. Before being changed over to 220,000-volt operation additional insulation units were added, making a total of eleven units on suspension and thirteen on dead-ends. Cast-aluminum shield rings having a diameter of 28 in. are used to distribute the electrostatic stress uniformly along the insulator strings. The conductors are 605,000-circ.mil aluminum, and each line has a capacity of 125,000 kw. at 220,000 volts. Auto-transformers forming a part of the line are used at each end except at Big Creek No. 8 power house, where 220,000-volt transformers were provided at the time the plant was built.



CAST-ALUMINUM RINGS (28 IN. DIAMETER) MAKE ELECTROSTATIC DISTRIBUTION ACROSS DISKS UNIFORM

Power Board Activities

Competition for New River Rights in West Virginia—Alaskan Permits and Timber Purchases

OWING to the fact that the market for electric power in southern West Virginia and northeastern Virginia is growing at a compounded rate of more than 20 per cent per annum, a determined fight before the Federal Power Commission is in prospect for the power site near Hinton, W. Va., on New River. The contending applicants are the Virginian Power Company, which has headquarters at Charleston, W. Va., where it is operating a 60,000-hp. steam plant, and the Appalachian Power Company, whose activities center at Roanoke, Va. The latter company owns most of the flowage lands required and is now contemplating pushing a development which calls for the construction of six plants on New River. The two lower plants would be in direct conflict with the application of the Virginian Power Company.

The Home Power Company, a public utility operating in Skagway, Alaska, has received a preliminary permit from the commission for a small project on the North Fork of the Skagway River. This development is made necessary by the fact that the present source of power is interrupted before the end of winter by the freezing of the stream. A license has been authorized for L. H. Carvey covering a small project on Archangel Creek, 70 miles north of Valdez, and another to B. A. Garver of Seattle covering two minor projects on Big and Little Kanatak Creeks, near the town of Kanatak, Alaska.

POLICY ON ALASKAN PERMITS

The Federal Power Commission and the Forest Service are about to agree upon a policy of co-ordination to apply in connection with combined power and pulp projects in Alaska. The power commission thus far has been granting preliminary permits in such cases with a requirement that the permittee shall purchase the necessary timber for his operations from the Forest Service. The effect of this plan is to limit competition for the sale of the wood, which led the Forest Service to propose that the timber be advertised for sale at the same time the power commission advertises the application. In this way the rights can be extended so as to safeguard better the public interest, it is contended. This plan may slow up initial action on the application, since timber sales must be advertised for four months, whereas applications for power rights need be advertised for only two months.

The license issued to the Wisconsin-Minnesota Light & Power Company, which required the stocking of its reservoir with muskellunge fish, has been amended to eliminate that provision.

Questions involved in the conflicting applications in the Little Falls-Pike Rapids case will be discussed at a public hearing to be conducted by the commission on June 7.

Insull Dinner for Merz

Visiting Engineer Expresses Views on Electric Developments and Tells of Progress in England

SAMUEL INSULL gave a dinner to Charles H. Merz of London at the Edison Restaurant, Chicago, on the evening of May 2, at which more than two hundred utility men and others were present. Mr. Merz is the head of the well-known engineering firm of Merz & McClellan, consulting engineers for the Commonwealth Edison Company, and, with some members of his staff, is in this country investigating the present status of electric power development in the United States. Mr. Insull, in introducing Mr. Merz, referred to him as having been connected with large electric power developments the world over and as an authority on the economical production and distribution of electrical energy as well as an engineer of great distinction and high ideals.

In responding, Mr. Merz spoke of the wonderful development attained by the electric power industry as shown by the fact that work is actually under way on a million-horsepower station. The reference, undoubtedly, was to the Crawford Avenue station of the Commonwealth Edison Company, for which Merz & McClellan are consulting engineers. Mr. Merz went on to sketch electric power conditions in Great Britain from the days of Joseph Chamberlain, the British statesman who had so much to do with the "municipalization" restrictions that have characterized this development. He described the present method of control by electricity commissioners in Great Britain and referred also to the modern and extensive electrical development in the Newcastle-on-Tyne region under private ownership. Recent electric power development undertakings in Australia and South Africa were mentioned, and Mr. Merz told how in the former country lignite or brown coal is being used for fuel.

In relation to railroad electrification the speaker brought the cheering news that the English companies favor centralized energy rather than the building of their own generating stations. On the general subject of massing the production and distribution of electrical energy Mr. Merz expressed himself in entire agreement with the ideas, promulgated many years ago, of Mr. Insull.

Underground Distribution Prevails

Underground distribution of electrical energy is highly developed in Great Britain, contrasted with the more usual distribution by overhead wires in this country. Even electric services to customers in small communities are underground. Thus distribution problems in Great Britain are rather different from those of the United States. The distribution is more likely to be regarded as a system separate from the production end. Outdoor switching stations are almost unknown. The 230-volt lamp is in almost universal use and has some advantages compared with the 115-volt lamp of this country.

The United States has seen one important advance in generating station practice which has no counterpart in Great Britain at present, the speaker said, and that is the use of very large steam boilers. For the future he believed that progress would be in the line of greater interconnection, more centralization, increase in the size of generating stations and higher steam pressures. With the large steam turbines, say of 50,000 hp. and upward, now in use, economies are obtained comparable with the highest efficiencies of internal-combustion engines. The latter at present cannot be made in very large sizes and are not to be had in units of more than 5,000 hp. This is not big enough for great modern generating stations, although in smaller plants the internal-combustion engine has obvious advantages, being economical in fuel and in labor. It should be watched by generating-station designers as it may be developed so that it will be available in larger sizes.

Mr. Merz concluded by declaring that while engineers must always work for the greatest economy in electric power production, they must never forget that to obtain this security and reliability must not be sacrificed.

Consumers' Power 100,000-Kw. Plant

Saginaw River Station to Use Cast-Iron Blocks in Place of Furnace Brickwork, Thereby Increasing Heat Absorption—Hydraulic Stokers—Water Sluicing of Ashes

THE Consumers' Power Company, Jackson, Mich., has started the construction of a 100,000-kw. steam generating station at Zilwaukee, on the Saginaw River, 3 miles north of Saginaw. The company has available an extensive acreage of land along the bank of this navigable river, so that in the future coal may be supplied to the plant by boat. At the present time, however, coal will be received by rail over the Grand Trunk and Michigan Central railroads. The initial installation will consist of two 25,000-kva. General Electric steam turbines. Operation is expected to start with the first unit about Dec. 1, and the second unit will, it is thought, be ready next March.

Each turbine unit will have two B. & W. boiler units, each having 8,870 sq.ft. of steam-heating surface and rated at 900 hp. These boilers will be fired by American Engineering Company type K underfeed stokers of a hydraulically driven type, using a Hele-Shaw pump system. The stokers will have a double row of clinker crushers. The steam pressure will be 375 lb. with 250 deg. F. superheat. A double bank of the Green Fuel Economizer Company's vertically baffled cast-iron economizers will be mounted directly above the boilers. They will have 8,500 sq.ft. of heating surface. Superheaters of the radiation type will be installed in the back walls of the furnaces by the Power Specialty Company.

The chief feature of the boilers will be the substitution of cast-iron blocks furnished by the Power Specialty Company for parts of the furnace lining. Through these cast-iron blocks water-cooled steel tubes will run which will circulate water at the same pressure as the boiler. It is expected that these water-cooled furnace linings will generate steam to correspond to a heat-absorption rate of 60,000 B.t.u. to 80,000 B.t.u. per square foot of exposed surface per hour. The building will be constructed of waterproof reinforced concrete up to any possible flood stage of the Saginaw River. Above that level the building will be a steel-supported brick structure. Steel stub stacks will be used, one for each boiler.

The coal-handling equipment will consist of a track hopper and an automatic vertical skip hoist, which will discharge the coal through crushing and weighing apparatus upon a shuttle belt conveyor, which will travel on a truck over steel-plate bunkers. Excess coal will be spouted by gravity from the skip-hoist tower back to the yard and spread out into storage by a drag scraper.

Ash Handling by Sluicing

Ash removal will be handled by means of a concrete sluiceway directly below the boilers supplied with water from the circulating system of the main condensers. As the ashes are ground through the clinker crushers of the stokers, they will drop to the secondary grates, from which they can be dumped by hand into the sluiceway. This sluiceway is to feed into a well so that the ashes may be raised by motor-operated manganese-steel-lined dredging pumps to a wooden launder which will carry the ashes mixed with water to the dumping grounds. These pumps will be capable of handling lumps of clinkers up to 8 in. in diameter. A grizzly will protect the pumps from clinkers larger than this size.

The make-up water will be purified by means of Griscom-Russell evaporators connected between the bleeders of the eighth and eleventh stages of the turbines. Each evaporator will have a maximum capacity of 10,000 lb. per hour. A condensate storage reservoir will be provided between the foundation walls under the boiler-room basement. This arrangement of evaporators eliminates a number of pumps and other auxiliaries generally found with a low-pressure evaporator plant. In this case the evaporator feed pump is also eliminated, as the water will feed to the evaporators by gravity from the cold-water house-service supply tanks. Deaëration of feed water will be accomplished by admitting all the con-

densate which has been exposed to the air in storage back into the system through the main condensers, which will have hot wells of special design. This will deliver the condensate practically free from dissolved air and at a much higher temperature than that corresponding to the pressure of the vapor in the condenser. Air for combustion will be admitted to the building through louvers and heaters in the top of the boiler room and drawn down through ducts, carrying with it waste heat from the boiler-room radiation losses into the forced-draft fan room. After passing through the fans on the way to the stoker wind boxes, the air will be preheated to a temperature of 250 deg. to 300 deg. F. by means of hot water and steam bled from the main units.

Since the power house will be nearly 800 ft. from the river, long intake and discharge circulating water ducts will be necessary. Two 22,000-g.p.m. pumps and one 35,000-g.p.m. pump will be built to operate the first two condensers. The Ingersoll-Rand condensers will be of the pear-shape type, being built for one pass only with ¾-in. tubes, and each will have a surface of 14,250 sq.ft., excluding the coolers.

Novel Fan Control

What is believed to be an original arrangement of motors and controls for the forced-draft and induced-draft fans has been developed. Directly connected to each forced-draft fan there will be a 25-hp., 720-r.p.m. and a 100-hp., 1,200-r.p.m. motor. These are to be 440-volt alternating-current slip-ring motors with the 720-rp.m. motor designed for safe overspread at 1,200 r.p.m. Each motor will have its controller, of the motor-operated drum variety, and the controllers will be so connected and interlocked that by the mere operation of one push-and-pull switch on the boiler-control board any fan speed from 360 r.p.m. to 1,200 r.p.m. can be obtained. When the drum controller of the small motor has reached its top speed, a contactor will automatically cut this motor off the power circuit, and another contactor will connect the larger motor, whose controller will then accelerate up to the maximum speed with the small motor coasting. The reverse operation is similar. Flashing lights will indicate each step of each controller. Each induced-draft fan is driven by a 40-hp. and a 150-hp. motor operated similarly, the 40-hp. motor being connected by a chain drive while the large motor is directly connected to the fan shaft. Fan speeds of 225 r.p.m. to 900 r.p.m. are provided for. The small motors will furnish the necessary draft for 70 to 80 per cent of the running time, the large motors being called upon only when the boilers are operated at the very highest ratings.

The turbines will generate at 12,000 volts, which will be stepped up to 24,000 volts by means of auto-transformers directly connected to each turbo-generator. These auto-transformers will be installed in the outdoor substation with no switch between them and the generators. Differential relay protection will be provided around the entire unit of generator and auto-transformer, so that a failure in either the generator, the connecting cables or the auto-transformer will trip the switch connecting the unit to the 24,000-volt bus, open the generator field and close the throttle.

The generators are to have an entirely self-contained air-cooling system, which will circulate the air past water-cooling coils, the total volume of air in the system being extremely small. The volume of air, in fact, will be so small that in case of an incipient fire in the generator windings the oxygen would hardly support combustion for the small amount of dust which might be present in the windings. On this account no water, steam or other fire-fighting equipment is to be provided.

Each exciter is to be a 110-kw., 250-volt shunt unit directly connected to the turbine shaft. Bracketed and directly connected to the end of this exciter will be a small 2-kw., 125-volt machine to excite the field of the 110-kw. exciter. No main series-field rheostat is provided, nor will a Tirrill regulator be used. The exciter rheostat is to be motor-operated and consist of two sections, the first section cutting in resistance in the field of the main exciter and the second section cutting in resistance in the 2-kw. generator field. There is no spare excitation whatsoever provided, although in case of trouble with the 2-kw. machine the main exciter fields could be readily excited from the station control battery, which has a voltage of 125.

Outdoors Equipment

Following the general practice of the company for the last ten years, all of the switching and transforming equipment will be installed in an outdoor substation erected adjacent to the steam plant. This will include the auto-transformers, the station power transformers, the step-up transformers for the 140,000-volt system and 24,000-volt and 140,000-volt buses and switching equipment. The 24,000-volt switches will be of the General Electric type KO-39B variety, rated at 50,000 volts.

The station power transformers are to be three 500-kva. self-cooled transformers stepping down from 24,000 volts to 480 volts, one bank supplying all the station auxiliaries for the first two units. Future units will obtain station auxiliaries from a second station power bank. To insure as much as possible against transformer failure, the station power transformers are to be built to 50,000-volt specifications.

The 140,000-volt substation will consist of a 45,000-kva. bank of transformers stepping up from 24,000 volts to 140,000 volts, together with switching equipment for the 140,000-volt lines. It is planned to install a duplicate 140,000-volt bus with electrically operated remote-control disconnecting switches connecting the line and transformer switches to either bus. In addition, there will be a bus-tie oil circuit breaker provided with electrostatic synchronizing equipment to enable the two buses to be synchronized. This outdoor substation will supersede the present indoor station at Zilwaukee, which is a portion of the original 140,000-volt system built in 1911. By means of this 140,000-volt system the energy of the new station will be available generally on the system, which already connects the Au Sable River dams with Flint, Owosso, Battle Creek, Jackson and, through frequency changers, with Grand Rapids and other cities served by the 140,000-volt, 30-cycle system.

The entire engineering and construction of the plant is being carried on by the engineering and construction departments of the Consumers' Power Company, H. F. Eddy, mechanical engineer, and J. H. Foote, electrical engineer, having direct charge of the design and engineering, and G. F. Stecker, assistant manager of construction, being in direct charge of building the station.

No Change in Control of the Crocker-Wheeler Company

At the annual stockholders and directors' meeting of the Crocker-Wheeler Company, held in New York on Wednesday, May 9, new officers were elected, the selections proving that there will be no change in policy or management because of the death of President Schuyler S. Wheeler. Edmund Lang, who was previously vice-president and secretary, was made president. Arthur L. Doremus was continued as vice-president, and Clarence N. Wheeler, the former controller, was elected to fill the vice-presidential vacancy caused by Mr. Lang's promotion. Herbert C. Petty, formerly assistant sales manager, became secretary and sales manager; Theodore S. Fuller was continued as treasurer, and George W. Bower was made assistant secretary and assistant treasurer. The existing board of directors was re-elected, the vacancy caused by Mr. Wheeler's death being left unfilled for the present. Besides the president and vice-presidents named above, these directors are Edward W. Brown, Hampton D. Ewing, E. B. Humpstone, Frank H. Jones, and Dr. M. I. Pupin.

F. A. E. S. Makes Appointments to Coal Committee

Appointment of four members of the committee to conduct an investigation into the storage of coal is announced by the Federated American Engineering Societies. They are P. F. Walker, dean of engineering, University of Kansas; S. W. Parr, professor of applied chemistry, University of Illinois; H. Foster Bain, director of the United States Bureau of Mines, and L. E. Young, Union Light & Power Company, St. Louis. The chairman is W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, Chicago.

Commercial Men Meet

Hoosier Association Devotes One-Day Session to Appliance Selling, Rural Rates and Refrigeration

SELLING appliances, rural extensions and electrical refrigeration received great attention at the Commercial Section meeting of the Indiana Electric Light Association at Indianapolis on May 3. A. W. Krueger, Edison Electric Appliance Company, answered the question as to whether a central-station company should merchandise appliances in the affirmative, basing his opinion on the experiences of central stations in many localities throughout the West. All electrical dealers, he thought, benefited by the pioneering work of the utility. Wallace O. Lee, Indianapolis, cautioned against price cutting if a utility desired the co-operation of the local contractor-dealers. T. Hatfield, a contractor-dealer, felt that since the utilities were virtually the backbone of the electrical industry, it was perfectly logical for them to handle merchandise, but unless prices were maintained dissatisfaction and jealousy on the part of other dealers would arise. R. Thurman chairman Commercial Section, and F. W. Buck thought that if the field was entered separate merchandising departments should be maintained.

NEW RURAL RATES

The newly proposed rural service regulations for Indiana were discussed by Earl Carter, chief engineer of the Public Service Commission. These rules follow those adopted in Wisconsin in that the rural charge is determined by a certain percentage of the total investment. For Indiana this charge is 10 per cent of the total cost of the new general and local construction. Besides this, there are the regular urban minimum and energy charges. Construction is handled under the supervision of the utility that assumes title upon completion of the extensions.

John W. Brockman, Brookville, raised the question of how connection charges for additional customers should be handled once the line had been completed. Mr. Carter said this connection charge was determined by dividing the total cost of the general equipment by the number of customers, and if this charge was higher than the additional cost of the general equipment, the company would refund the difference to the consumers on that line, including the new users.

At the afternoon session D. M. Jones, Schenectady, N. Y., presented the economic side of poor power factor, explaining his subject by concrete examples. C. W. Johnson spoke on the value to central stations of increasing their load by the sale of refrigerators for private residences. By assuming an average residential yearly lighting bill of $19 against a 800-kw.-hr. consumption for a refrigerator which would give a return of $59, Mr. Johnson showed that the refrigerator load was a virgin field which would be an excellent revenue producer. H. E. Crane, Fort Wayne, however, cautioned against too much enthusiasm in selling these machines, thereby forgetting the necessary servicing. He estimated the average daily cost of his own refrigerator at 12 cents.

At the banquet on Thursday evening W. H. Morton, Sanborn Electric Company, Indianapolis, and C. C. Perry, president Indianapolis Light & Heat Company, spoke.

Will Consider Illuminating Engineering Nomenclature

Thirteen men, consisting of six representatives of producers, three representatives of consumers and four representatives of general interests, constitute the personnel of the sectional committee on illuminating engineering nomenclature and photometric standards, one of the projects officially before the American Engineering Standards Committee. The Illuminating Engineering Society has been named sponsor for this project. The men who constitute this committee, and the organizations which they represent, follow:

American Gas Association, W. J. Serrill; American Institute of Electrical Engineers, A. E. Kennelly; Bureau of Standards, A. S. McAllister; Illuminating Engineering Society, Howard Lyon and G. H. Stickney; National Committee of International Commission on Illumination, Louis Bell; National Committee of International Electrotechnical Commission, C. O. Mailloux; National Council of Lighting Fixture Manufacturers, E. C. McKinnie; National Electric Light Association, C. H. Sharp; Optical Society of America, E. C. Crittenden; American Physical Society, E. P. Hyde; individuals, G. A. Hoadley and M. Luckiesh.

Electrochemists Discuss Many Furnace Applications

The forty-third meeting of the American Electrochemical Society, held at New York on May 3, 4 and 5, was attended by 250 members and guests. The technical papers of the first day included symposiums on electrode potentials and electrodeposition. On Friday, among other subjects, "Heat-Insulating Material for Electrically Heated Apparatus" was discussed by J. C. Woodson, "Methods of Handling Materials in the Electric Furnace and the Best Type of Furnace to Use" by Frank W. Brooke, "Relation Between Current, Voltage and the Length of the Carbon Arcs" by A. E. R. Westman, and "Electric Furnace Detinning" by C. E. Williams, C. E. Sims and C. A. Newhall. Saturday was given over to papers on the production and application of the rarer metals.

J. W. Hinckley of the National Carbon Company was elected president of the society for the ensuing term. E. G. Acheson was elected an honorary member.

Electric Truck Promotion

Interested Bodies Unite for a Co-operative Program with Many Ramifications

NO LESS than twelve associations, groups of associations or groups of individuals are united in the "electric truck business development program" recently formulated in conference by representatives of these associations and to be put into effect through the Joint Committee for Business Development. These twelve bodies include, in addition to the committee just named, the Electric Motor Truck and Car Bureau, the Commercial Section and the geographic divisions and state associations of the National Electric Light Association; the Associated Manufacturers of Electrical Supplies, the Society for Electrical Development, the Electric Truck Association of New York, local electrical leagues and three groups of manufacturers directly concerned, namely, makers of electric trucks, of industrial trucks and of storage batteries.

The aims of the program are (1) to inform and interest the electrical industry generally regarding the possibilities and advantages of electric truck business; (2) to interest central-station companies generally regarding the possibilities and advantages to them in cultivating an electric truck load, and (3) to provide for the industry practical advertising and sales helps and concrete suggestions for developing electric truck business.

WORK TO BE DONE

The work of those in charge of this program is to cover the obtaining of data needed by the society in connection with the compilation of literature, editorial assistance in the preparation of articles to be released to the electrical trade press, the appointment of an advisory committee to aid participating organizations, preparing and maintaining a mailing list, gathering and distributing statistics, preparing for not less than 500 daily newspapers articles on the advantage of electric trucking, preparing articles both for popular magazines and for the electrical trade press, forming local committees, supplying selling suggestions and advertising copy, preparing material for lectures to the industry and to the public, arranging for the mention of electric trucks at meetings within the industry, preparing material for broadcasting by radio, preparing suitable printed matter for use within the industry and for distribution to consumers, and promoting classes for electric truck salesmen as detailed in the ELECTRICAL WORLD for May 5, page 1057.

Charles R. Skinner, Jr., manager of the automobile bureau of the New York Edison Company, has been made chairman of the advisory committee, of which other members are O. R. Hogue, chairman Commercial Section, N. E. L. A., and W. L. Goodwin, representing the Society for Electrical Development.

Joint Committee for Business Development at Work

At a recent meeting of the executive committee of the Joint Committee for Business Develoment W. E. Clement, commercial agent of the New Orleans Public Service, Inc., was elected a member, thus giving representation to the South and Southwest and making a direct point of contact with the sectional joint committee which has been formed in the Southwestern Geographic Division of the National Electric Light Association, of which Mr. Clement is general chairman.

It was announced at the meeting that there are now 641 accepted correspondents of the joint committee in various parts of the country, and that there is a total of 1,341 with whom correspondence is being carried on with a view to having them serve. The hearty support of the committee was pledged to the "Better Homes in America" movement.

A co-operative program is being worked out with the American Bakers' Association which will assume definite proportions at an early date, and it was announced that satisfactory progress had been made in the adoption of a minimum iring standard. A report concerning this will probably be made within sixty days.

An extensive campaign dealing with the electric range was outlined by Oliver R. Hogue, chairman of the Commercial National Section, N. E. L. A. Charles R. Skinner, Jr., reported progress upon contemplated electric vehicle activity. A. K. Baylor reported that he was at work on a consumer booklet to be known as "Better Outlets for the Home." The booklet being prepared by the electric heating and melting department, Chairman C. K. Nichols reported, will soon be ready for final approval. C. E. Greenwood, chairman of the domestic and industrial appliances department, stated that the monograph his department had prepared on the vacuum cleaner had been completed and was ready for distribution. He announced that his department contemplated publishing a booklet on electric refrigeration at an early date. The chairman of the electric lighting department, P. B. Zimmerman, reported that a very complete monograph on domestic lighting had been issued and was ready for distribution.

A comprehensive program of booklets covering various fields was reported by William L. Goodwin of the Society for Electrical Development as ready. Louis D. Gibbs, chairman of the publicity advisory council, announced that the council is working to secure representation from all the associations affiliated with the joint committee.

Conference Takes up Problems of Apparatus Users

A conference of men interested in the use or the manufacture of scientific instruments and apparatus was held recently at the headquarters of the National Research Council in Washington. It was attended by members of government scientific bureaus, scientific societies, universities, the Association of Scientific Apparatus Makers and individual firms. Dr. Burgess, director of the Bureau of Standards, presided. It was resolved that a committee of apparatus makers and users should be formed under the Research Extension Division of the council. This committee is to consist of one representative from each of eleven technical societies and organizations, including the American Institute of Electrical Engineers; two representatives from the Bureau of Standards and the National Research Council and six representatives from the Association of Scientific Apparatus Manufacturers, with members-at-large to be appointed by this committee.

The principal discussions at the conference ranged around apparatus supply, standardization of apparatus, information service and inspection service.

New Electrical Safety Rules for Indiana

The State Fire Marshal of Indiana, Newman T. Miller, has, in the interest of safety, promulgated the following rules for all new electrical installations or alterations:

1. Service entrance wires, from point of contact with the building up to and including the switch, meter connections and main cut-out fuses, must be completely inclosed within steel.

2. Continuous rigid metallic conduit must be used from point of contact with the building to and terminating within the service entrance switch and affixed rigidly thereto.

3. Service entrance switches must be of the externally operated safety inclosed type and provide means for sealing the inclosure containing the main cut-out switch and fuses.

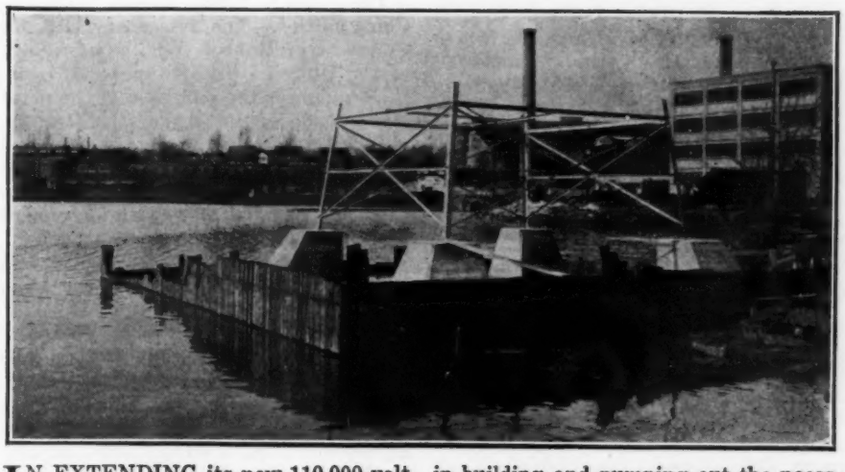
Switches must also provide means for entirely inclosing the meter connection wires within steel.

Union Electric Light & Power Seeks to Expand

The Union Electric Light & Power Company of St. Louis has asked the Public Service Commission of Missouri for approval of its purchase of three properties which will give the company a string of electric utilities extending from St. Charles, Mo., on the north through southeastern Missouri to the northern boundary of Arkansas.

One group of properties which the company desires to purchase includes the St. Louis Light & Development Company, valued at $1,695,105; the Cape Girardeau & Jackson Interurban Railway, valued at $379,530; the St. Charles Electric Light & Power Company, valued at $106,591, and the Iron County Electric Light & Power Company, valued at $17,355. The second application asks permission to take over the Western Power & Light Company of St. Louis County, valued at $277,911, and the third application is for authority to purchase the lighting plants of the Missouri Public Utility Company at Bonne Terre, Cape Girardeau, Calfee, Charleston, East Prairie, Webb City, Sikeston and other smaller towns in southeastern Missouri.

Building a Transmission Tower in a Lake



IN EXTENDING its new 110,000-volt line to Pittsfield, Mass., the Turners Falls Power Company was forced to build the abutments for one tower 50 ft. out from the shore of a small lake in the city limits, owing to the existence of a municipal ordinance making provision for a roadway along the shore of the lake to be built at some uncertain future date. It was at first planned to build a solid concrete pyramidal base, but so much difficulty was experienced in building and pumping out the necessary cofferdam that it became necessary to build individual piers for each leg of the tower. These are, however, tied together with arches of reinforced concrete. They extend 45 ft. down under water to bedrock. The work was done under trying winter conditions, and this one tower cost the power company nearly $35,000, or as much as forty similar towers constructed across open country.

Brief News Notes

Utica Rates Going Down.—Officials of the Utica Gas & Electric Company have announced a reduction in rates for electricity used for lighting and power. The new schedule will represent a cut in cost to the consumer of about 10 per cent. The company says the new schedules will be operative by Oct. 1.

San Diego Consolidated's Good Year.—The San Diego Consolidated Gas & Electric Company reports that its electric operating revenue for the year 1922 was $2,169,025 and its electric operating expenses $1,541,470, giving a net operating electric revenue of $627,555. The company declared dividends of $528,843 during the year, leaving an accumulated surplus of $50,866.

Eldora, Iowa, Is Connected with Transmission Line.—A transmission line from the lines of the Iowa Falls Electric Company and the Iowa Railway & Light Company now furnishes service to Eldora, Iowa. The Iowa River Light & Power Company at Eldora has built this transmission line to Cleves and is receiving energy from the plants at Cedar Rapids, Iowa Falls and Marshalltown.

Oxford, Ohio, Resolves to Keep Municipal Plant.—Acquirement of new equipment for the municipal light and power plant at Oxford, Ohio, on a "lease-purchase" basis, was authorized by the City Council recently, after a proposal by the Ohio Gas & Electric Company to supply energy to the city on a wholesale basis on a ten-year contract had been rejected.

Southern Indiana Gas & Electric Report.—The Southern Indiana Gas & Electric Company of Evansville, which operates electric, gas, steam-heat, street-railway and interurban railway plants, had a combined net income for 1922 of $206,863, or $10,964.91 more than for 1921. The net income is the amount left after paying operating expenses, including taxes and depreciation, and after paying interest on debt. The company's surplus was $429,735.

Municipal Ownership Wins in Red Wing, Minn.—By large majorities the entire ticket favoring the construction of a municipal electric light and power plant has been elected in Red Wing, Minn., over the candidates advocating the purchase of energy from the Wisconsin-Minnesota Light & Power Company. The victory of municipal ownership comes after a bitter fight lasting over a period of many years.

Southern Sierras Power Company's Report.—The Southern Sierras Power Company, operating in Riverside, Hemet, San Bernadino and vicinity, reports to the California Railroad Commission for the year 1922 that its operating revenue was $2,010,744 and its operating expenses $814,075, giving a net operating revenue of $1,196,669. The net corporate income for the year was $79,053 and surplus $137,501.

Oskaloosa Loses Permit.—Failure to do the preliminary work required by the Federal Power Commission has resulted in the revocation of the preliminary permit granted the city of Oskaloosa, Iowa. The city had a plan for developing power on the Des Moines River.

Geneva, Ill., Gives up Municipal Plant.—The municipal generating plant of Geneva, Ill., has come to an end, and the city is henceforth to be served from the lines of the Chicago, Aurora & Elgin Railroad through its subsidiary, the Chicago Suburban Power & Light Company. The new rates will be lower than the cost of manufacture by the city, which will continue to distribute the electricity after transforming it from 30,000 volts to 2,300 volts.

Study of California Rivers to Be Made.—A study of the American River and of the proposed diversion of the Trinity into the Sacramento River is to be made by a board to be composed of a representative each of the War Department, of the Interior Department and of the Department of Agriculture. The study is to determine the best scheme of developing the power, irrigation, flood-control and navigation features of these rivers.

Central Illinois Buys Athens Plant.—The Central Illinois Public Service Company has purchased the Athens (Ill.) electric light plant and is now serving 195 communities with electric light and power. Business of the company is increasing rapidly. The average daily output of the Muddy power station has reached 220,000 kw.-hr., largely the result of the company's new contract with the Old Ben Coal Corporation, which it is serving with electrical energy for the operation of its coal mines.

Lena (Ill.) Plant Serves Eighteen Communities.—The Wisconsin Utilities Company of Monroe, Wis., a subsidiary of the United Utilities Company, Lena, Ill., announces the purchase of the plant and outside equipment of the Orangeville Electric Light & Power Company and its plan to supply that city with electricity. The Wisconsin Utilities Company has also signed an agreement with Clarno to furnish electricity there, making eighteen communities which will receive light and power from the Lena plant.

California Oregon Power Company Busy.—Three major construction jobs for the California Oregon Construction Company are under way. Work is progressing on the 20-mile extension of the 66,000-volt transmission system in Klamath County to the town of Chiloquin. This line will be completed in May. A suction dredge is being built to operate on Upper Klamath Lake in connection with the lake regulation project of the company. This will be ready for service this month. The transmission line from Fall Creek to Yreka, which was built in 1903, will be rebuilt and relocated.

New Orleans Plant Must Have More Water.—So much water has been used by the electric power plant of the New Orleans Public Service, Inc., at the foot of Market Street, since the installation of the new 20,000-kw. turbine-generator that it has been found necessary to augment the supply by building a new reinforced-concrete intake tunnel, 8 ft. x 10 ft., at a cost of about $500,000. Work will be started when the Mississippi River reaches a lower level. More water is consumed by the electric power plant than by the rest of the city combined, the power house requiring when operating at full capacity 11,570,000 gal. an hour.

Missouri Pacific Abandons Steam Plant for Central-Station Service.—The Missouri Pacific Railway Company has recently arranged to purchase electric service from the Union Electric Light & Power Company of St. Louis for the operation of all electric equipment at its shops in Dupo, Ill. The St. Louis company will deliver this service to the railroad company yards just south of St. Louis in the form of three-phase, 60-cycle, 13,200-volt energy, the Missouri Pacific Railway having installed a submarine cable across the Mississippi and constructed a 3-mile transmission line to Dupo and a 300-kva. substation. This contract means the abandonment of a steam plant which has been in operation at the Dupo shops for a number of years.

San Francisco Holds Radio and Electrical Exposition.—The National Radio and Electrical Exposition held in the Civic Auditorium, San Francisco, during the week of April 2 proved so successful that it has been decided to make it an annual event. It is estimated that twenty-five thousand persons visited the show during the six days it was in progress. The exposition was held primarily to demonstrate the progress that has been made in the art of radio communication, but electrical interests that had other displays capitalized on the public's interest in radio by showing the latest devices and appliances. Among the unique exhibits was a large illuminated map showing the power plants and the transmission system of the Pacific Gas & Electric Company.

Government Engineers Continue Study of Snake River.—The study of the power resources of Snake River begun in 1920 by an examination of the river between Huntington, Ore., and Lewiston, Idaho, by engineers of the United States Geological Survey was continued in 1921 by a similar examination of the river in southern Idaho, between Milner and Weiser, and manuscript copies of the report for that year are open for public inspection at the office of the Geological Survey in Washington and at the office of the district engineer at Boise. The report gives a history of the present development of power in southern Idaho and contains maps and descriptions of nineteen sites at which 250,000 hp. more could probably be developed even during times of low-water flow. It sets forth the amount of water available for power development and the schemes by which

the fullest use may be made of the water.

Consummating Indiana Consolidation.—The Wabash Valley Electric Company has petitioned the Indiana Public Service Commission for authority to buy the Putnam Electric Company, Cayuga Electric Company, Martinsville Gas & Electric Company, Spencer Light, Power & Water Company, Gosport Electric Company, Morgan County Light & Power Company and Roachdale Electric Company and to issue $1,561,700 of new securities to finance the deal. The petition says the properties are worth at least $2,073,000, against which there will be $1,811,700 in securities. The Central Indiana Power Company, which owns all the common stock of the Indiana Electric Corporation, owns the Wabash, Putnam and Cayuga companies, all of which were concerned in the hard-fought Indiana Electric Corporation case of 1921-1922. The whole system is to be provided with energy, in part at least, from the power plant which the Brewer interests are building near Terre Haute.

Associations and Societies

H. A. Lewis to Speak to New England Merchandising Bureau.—H. A. Lewis of *Electrical Merchandising*, New York, is scheduled to address the Merchandising Bureau of the New England Division, N. E. L. A., upon "Compensation for Merchandising Salesmen," at the Congress Square Hotel, Portland, Me., at 1 p.m. Wednesday, May 16.

American Welding Society's New President.—In the ELECTRICAL WORLD'S report, on page 1053 last week, of the New York meeting of the American Welding Society it was erroneously stated that the president-elect, T. F. Barton, was "of the General Electric Company." Mr. Barton is master mechanic of the Delaware, Lackawanna & Western Railroad.

Wenatchee Starts Electric Club.—Power company representatives and electrical men of Wenatchee, Wash., met at an informal dinner recently for the purpose of organizing a local electric club. Ray U. Muffley, manager of the Washington Coast Utilities, was elected temporary chairman. The following officers were elected: President, Lewis Shreve; vice-president, V. R. Wright; secretary, W. A. Buttles; treasurer, H. L. Clark.

Kansas Metermen Organize.—At the close of the first annual meter school held by the department of electrical engineering of the Kansas State College at Manhattan, Kan., which was attended by fifty men, a permanent organization of Kansas metermen was effected. J. E. Brown of the Kansas Electric Power Company was elected president, and F. H. Pumphrey of Wichita and A. C. Krachy of Ellsworth committeemen.

Power Development to Be a Topic at A. S. M. E. Convention.—At the spring meeting of the American Society of Mechanical Engineers, to be held at Montreal on May 28-31, Julian C. Smith will discuss "Power Development in the Province of Quebec," Frederick A. Gaby "Development of Hydro-Electric Power Plants in Ontario," and H. G. Acres "Modern Hydraulic Turbines of Large Capacity."

Empire State Gas and Electric Association.—At the meeting of the electric section of this association on Thursday and Friday next week there will be reports from the following committee chairmen: Street lighting, K. V. Farmer, Syracuse; boiler-room operation, A. C. Jordon, Elmira; hydraulic power, H. G. Davis, Watertown; transmission lines, E. P. Peck, Utica; overhead distribution, H. W. Watt, Mount Vernon, and underground systems, R. A. Paine, Jr., Brooklyn.

North Central, N. E. L. A., Convention Postponed.—The convention of the North Central Geographic Division, N. E. L. A., originally scheduled to be held at the Curtis Hotel, Minneapolis, on June 13-15, will instead be held at the Radisson Hotel, in that city, on June 20-22. This postponement, the officers announce, has been necessitated by the mistake of the Curtis Hotel management in booking the convention for a week previously assigned by it to another gathering.

May Section Meetings of A. I. E. E.—Section meetings of the American Institute of Electrical Engineers still to be held this month are announced as follows: Baltimore, May 18, "Lighting of Factories and Office Buildings," Earl A. Anderson; Boston, May 15, annual entertainment; Cleveland, May 24, address by President Jewett; Erie, May 14, "Science of Musical Sounds," Dayton C. Miller; Philadelphia, May 14, C. J. Russell; Seattle, May 16, "Long-Distance Telephone Toll Cable;" Worcester, May 17, address by President Jewett.

American Engineers Honor French Colleagues.—A joint meeting of the four major engineering societies of America with the American Section of the Société des Ingénieurs Civils de France was held in New York on May 4, in honor of the seventy-fifth anniversary of the founding of the French society. Harrington Emerson, president of the American Section; Gaston Liebert, director of the French Bureau of Information; C. O. Mailloux, the president of the International Electrotechnical Commission; William Barclay Parsons, Arthur S. Dwight and Henri Vigneron spoke.

Gerard Swope Addresses St. Louis Electrical Board.—Gerard Swope, president of the General Electric Company, addressed the St. Louis Electrical Board of Trade on the subject of "The Future of the Electrical Industry" at its regular weekly luncheon at the Statler Hotel on May 1. Louis H. Egan, president of the Union Electric Light & Power Company, was chairman. Mr. Swope said that only about 30 per cent of the nation's industrial plants are operating with electric service. He also saw a great opportunity for steam railroad electrification, pointing to the strides that Italy has made along this line.

Change of Meeting Place for Lighting Fixture Manufacturers.—The place for holding the midsummer convention of the National Council Lighting Fixture Manufacturers has been changed from Hot Springs, Va., to Buffalo. The date, June 26-28, remains unchanged. On the first day there will be a design program under the direction of E. T. Caldwell, and the following questions will be taken up: (1) "Which is the more important, designing or merchandising?" (2) "Should the lighting-fixture industry follow period design as the furniture industry has done?" (3) "Are the designers asleep?" On the second day a publicity program will cover: (1) Value of a national publicity campaign to a trade association; (2) possible development of dealer contact in a publicity campaign; (3) merchandising possibilities for the individual manufacturer in an association publicity campaign. The last day will be given over to a business meeting.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N Willis, 403 Slaughter Bldg., Dallas, Tex
Empire State Gas and Electric Association. Electric Section—Utica, N. Y., May 17-18 C. H. B. Chapin, Grand Central Terminal New York.
Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.
Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.
American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.
National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.
California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.
Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.
North Central Division, N. E. L. A.—Minneapolis, June 20-22. H. E. Young, Minneapolis General Electric Company.
Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.
Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. F. L. Bishop, University of Pittsburgh.
Canadian Electrical Association—Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.
American Institute of Electrical Engineers—Annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.
American Society for Testing Materials—Atlantic City, June 25-29.
Iowa Section, N. E. L. A.—Mason City, June 26-29.
Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29. Frederic Nicholas, 30 East 42d St., New York.
National Council Lighting Fixture Manufacturers—Buffalo, June 26-28. C. H. Hofrichter, 233 Gordon Square Bldg., Cleveland.
Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.
Ohio Electric Light Association—Cedar Point, July 10-13. D. L. Gaskill, Greenville.
New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.
Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28.

Recent Court Decisions

Where Evidence Is Equally Consistent with Existence or Non-Existence of Negligence Jury Is Not Competent.—In a suit brought by one Martin against the Louisville Gas & Electric Company the plaintiff claimed damages for injuries caused by a fall from a ladder lawfully placed by defendant to take the place of cellar stairs temporarily removed to facilitate the laying of conduit. The evidence was held by the Court of Appeals of Kentucky to be equally consistent with the theory of the ladder having slipped or the plaintiff herself having done so, and therefore the trial judge was held to have done right in withdrawing the case from the jury and finding for the defendant, in the absence of testimony to establish its negligence. (248 S. W. 868.)*

Federal Court Possesses No Jurisdiction in Suit to Enjoin Forfeiture of Franchise Rights by Judicial Process.—In dissolving an injunction granted to the St. Johns (Fla.) Electric Company against the city of St. Augustine, the United States Circuit Court of Appeals held that where an electric light and railway company was informed by the city that if it failed to comply with a resolution requiring it to make certain repairs the city would take steps to forfeit its right to use the streets in connection with its electric light business, as well as its railway business, and where it is the city's intention to do this by judicial proceeding, a suit to enjoin such proceedings involves no question under the United States Constitution giving jurisdiction to a federal court, even though there is not sufficient ground for forfeiture. (286 Fed. 474.)

Public Must Have Opportunity for Hearing Before Commission Fixes Rates.—Asserting, in Jones vs. Montpelier & Barre Light & Power Company, that the authority of the Public Service Commission of Vermont to make orders affecting rates depends on due notice to the parties interested, the Vermont Supreme Court has declared that where a public service corporation filed with the commission schedules showing rates for electricity which were in force and also a schedule of rates to become effective later, and where this additional schedule was protested and ordered discontinued, and no appeal was taken or request for a rehearing made within the statutory period, the company's motion for rehearing in which it requested the commission to fix a rate effective as of the date petitioned for in place of the one requested can be treated only as a petition to pass on a schedule not previously filed with the commission or made known to the public. (120 At. 103.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Erroneous Instruction on Insulation of Broken Wire.—A steam-shovel operator who broke a transmission wire with the boom of his shovel got down from the machine, picked up one end of the wire and was instantly killed. In reversing for the second time a judgment for damages (Hollis vs. Kansas City Light & Power Company) the Kansas City Court of Appeals found the instructions given to the jury to have been in error because they disregarded how or why the wire fell and stated a case of liability beginning with the wire on the ground and its state of insulation after it had fallen regardless of whether the action that caused it to fall was also the cause of the defective insulation. Although negligence and contributory negligence were questions for the jury, the petition was not based on the company's action in maintaining an electric wire close to a coal yard where it was likely to be broken regardless of its insulation, but on the alleged long-continued maintenance of the wire without sufficient insulation, and instructions to the jury should have been in accordance with this fact. The case was therefore remanded for a third trial. (248 S. W. 634.)

Deduction of Depreciation Fund from Rate Base Held to Have Been Error.—The action of the New York Public Service Commission in deducting a depreciation fund from the rate base of a natural-gas utility was held to be error in People ex rel. Pennsylvania Gas Company vs. Commission. The State Supreme Court said: "The commission seems to have determined that all sums of money collected from consumers for depletion of capital and carried to depreciation account, less such sums as might be traceable into free investments, whether used for replacement or enhancement of capital, constituted a fund which, whatever its converted form, could not be included in reckoning the capital constituting a proper rate base. That this cannot be true is shown by a simple illustration. Assume that the relator were presently embarking in the natural-gas business; that it owned ten wells each having its own acreage of gas fields; that each well with its fields was fairly worth $10,000; that consumers would so deplete its gas supply that in ten years the ten wells and fields would be exhausted. It is plain that in such case the consumers should annually pay, in addition to a suitable charge for service, the value of one gas well and field, or the sum of $10,000. If the consumers paid such a charge for ten years, then the relator might each year buy a new gas well with new field, or at the end of ten years buy itself ten new wells with gas fields, and thus place itself, not in a better, but in the exact position occupied by it when it began business. Clearly in such case the relator should be allowed a continuance of its charges for gas based on the full value of its capital without deductions. If sums annually collected from consumers for depletion of capital and actually used for such replacement must be deducted from capital invested to determine a rate base, then it is not apparent why such collections are ever permitted. If the commission intended merely to determine that sums of money collected for depletion which added to capital should be deducted, then the commission was likewise in error when it made the deduction in question. This is true for the reason that there is no proof that the sum was collected from consumers for depletion and used to increase capital rather than to replace it." (198 N. Y. S. 193.)

Commission Rulings

Power Company Not Compelled to Incur Large Expense to Avoid Possibility of Inductive Interference.—In passing on an application from the Blue River Power Company for permission to construct a transmission line in certain territory, the Nebraska State Railway Commission refused to compel it to incur a substantial cost in order to avoid one mile of additional parallel with metallicized telephone circuits. The route that appeared to afford the fewest natural obstacles and parallels to telephone lines was selected, and the commission said that where the telephone circuits were metallicized, as all the important ones in this territory were, the inductive interference from power lines operating under normal conditions at ordinary voltages would not materially affect communication over the telephone wires.

Michigan Commission on Financing of Utilities.—In refusing to the Sault Ste. Marie Gas & Electric Company authorization for additional stock issues and modifying an order relating to refunding bonds, the Michigan Public Utilities Commission made these pronouncements: A deficit resulting from the failure of a public utility to earn a 7 per cent return upon the rate base is no foundation upon which to base the issuance of common capital stock; a public utility should not be permitted to issue stock based on reorganization expenditures made seven years ago and prior to commission regulation; a public utility company should not be permitted to issue stock based on rate-case expenditures not charged to operating expenses, since these expenditures are properly amortized over a period of years; a public utility cannot and should not sell any preferred stock for less than par under the laws of Michigan. No commission, it was further decreed, should be paid for the sale of preferred stock of a public utility company when it appears that one individual is the owner of virtually all of the capital securities and that the issue of stock, together with other matters affecting capitalization passed on by the commission, amounts to a reorganization of the corporation.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

J. D. Andrew Vice-President of Stevens & Wood, Inc.

James D. Andrew has returned to the public utility engineering and construction fields by accepting the post of vice-president and district manager of Stevens & Wood, Inc., with offices at New York and Youngstown, Ohio. Mr. Andrew's headquarters will be at Youngstown, and one of his first activities will be charge of the construction of the 200,000-kw. superpower plant to be erected by his firm on the Ohio River. In returning to the public utility field, Mr. Andrew resigned as president of the American Balsa Company, a subsidiary of the American International Corporation, with which organization he became connected in war times, when, in 1917, he left his position as superintendent of station engineering for the Edison Illuminating Company of Boston to take a prominent part in the building of the great Hog Island plant.

Mr. Andrew was born in 1874 and was graduated from the Columbia School of Mines in 1897. He spent three years in erecting and testing engines for the E. P. Allis Company, Milwaukee, and the next three years as mechanical engineer of the Metropolitan Street Railway, New York. He then joined the New York Edison Company as chief engineer. Tempted by commercial activities, he next became general manager of the Virginia & Alberine Soapstone Company in charge of production and manufacture. The public utilities claimed him again when the Boston Elevated Railway made him superintendent of power, which position he relinquished to ally himself with the Edison Illuminating Company of Boston.

During 1916, however, he received leave of absence to go to South America for the Chili Copper Company to build and inaugurate a 40,000-kw. power plant.

Frank L. Ostler has been appointed secretary of the Public Utilities Commission of Utah, to succeed T. E. Banning, who resigned last February. Mr. Ostler has had considerable experience in rate work.

R. E. Thompson recently resigned as manager of the Deming (N. M.) Ice & Electric Company to become power superintendent for the Springfield (Mo.) Gas & Electric Company.

H. S. Bastian, assistant engineer of the Portland (Ore.) Railway, Light & Power Company, has resigned to take charge of the new district office of Charles C. Moore & Company. For a year before allying himself with the Portland Railway, Light & Power Company Mr. Bastian was engaged in private practice, chiefly mechanical and power-plant work. Previously he was associated with the Southern Pacific Company at San Francisco and also with the Oregon-Washington Railroad in Portland.

W. H. Burke Goes to Iowa

Walter H. Burke, who has been transferred to Keokuk, Iowa, as manager of the railway, lighting, power and gas properties of the Keokuk Electric Company, as was announced in the April 21 issue of the ELECTRICAL WORLD, has been in the Boston office of Stone & Webster for some years and has in recent months been in charge of matters pertaining to the Southwestern group of properties under this management. Mr. Burke was graduated from the University of Maine in 1906. After serving for a time with the General Electric Company, he held various operating positions in the utility field, including that of assistant general superintendent of light and power for the Milwaukee Railway & Light Company and that of assistant to the manager of the railway, lighting and power property at Dallas, Tex. He has been a frequent contributor to the technical press, particularly on the economic phases of the public utility business. He assumed his new duties May 1.

W. H. BURKE

M. C. Rypinski, vice-president and general sales manager of C. Brandes, Inc., New York City, has started on a trip abroad. He will make his first stop in England, at the firm's London plant, to determine the advisability of its further expansion in order to keep up with the increasing demand for radio apparatus. He will then go to Paris and afterward into Germany. Mr. Rypinski will remain in Europe for a somewhat indefinite period.

Rudolph P. Miller of New York has been reappointed representative of the Federated American Engineering Societies on the National Board for Jurisdictional Awards.

J. I. Searles, who has been connected with the Menominee & Marinette Light & Traction Company since 1922, when he left the Wisconsin Railway, Light & Power Company at Winona, Minn., has severed his connection with the former company to ally himself with the Lake Superior District Power Company at Ironwood, Mich.

Herbert L. Fisher is now doing appraisal work with Stone & Webster, Boston. Mr. Fisher was formerly resident engineer with the Goodyear Tire & Rubber Company; then he joined the St. Croix Paper Company as assistant engineer of hydraulic construction, and later he was with the J. McCormick Construction Company, Philadelphia.

William R. Bullard has severed his connection with the United Electric Light & Power Company of New York, after seven years of service, to ally himself with the Electric Bond & Share Company, New York City, as assistant engineer in connection with the design and development of underground distribution systems.

W. P. Strandborg of the Portland (Ore.) Railway, Light & Power Company, president of the Public Utilities Section of the Associated Advertising Clubs of the World, has been appointed a member of the general reception committee to receive representative advertising and business men of the British Empire who will arrive in the United States the latter part of May for a tour of the Eastern and Middle Western sections of the country. The delegation will be composed of publishers, advertising specialists and representatives of large British industrial concerns. The party will attend the annual convention of the Associated Advertising Clubs of the World at Atlantic City early in June.

William H. Crawford, manager of the department of industries of the Portland (Ore.) Chamber of Commerce, has resigned to become affiliated with the California-Oregon Power Company. He has been appointed to organize a new service in the company, to be called the "new industries department," which will have for its purpose the encouragement of commercial development in the districts of southern Oregon and northern California served by the lines of the company. Before going to the Pacific Coast in 1902 Mr. Crawford spent two years in the Orient with Frazar & Company, importers, and several years on the Atlantic Coast selling railway appliances. Subsequently he was with Charles C. Moore & Company, engineers of San Francisco, for thirteen years, and he has also been associated with the Simmen Automatic Railway Signal Company of New York.

H. W. Burmeister has been made manager of the Flambeau Public Service Company's office at Phillips, Wis.

R. H. McLain recently resigned from the Maine Electric Company, Portland, Me., as sales manager and is now connected with the General Electric Company at its New York office.

David Ross, formerly connected with the Hydro-Electric Power Commission of Ontario, is now associated with the Electric Bond & Share Company, New York.

John W. Carpenter, vice-president and general manager of the Texas Power & Light Company of Dallas, has been made chairman of the public utilities committee of the Texas Chamber of Commerce.

E. B. Powell, consulting engineer, of Stone & Webster, Inc., Boston, has returned from France much improved in health. While abroad Mr. Powell was confined to the American Hospital at Neuilly for three months.

W. F. Chadwick, formerly assistant superintendent of gas and electric plants for the Connecticut Power Company, New London, Conn., has been transferred to the mechanical engineering division of Stone & Webster, Inc., at Boston.

Fred Brown, manager of the Mountain States Power Company in Eugene, Ore., for the last five years, has resigned. He has purchased an interest in the Buffelon Lumber Company and will have charge of the auditing and accounting for the firm.

F. P. Nightingale, who was formerly connected with the General Electric Company and who has just returned from a three years' stay in China in the interest of that company, is now connected with the Los Angeles office of the Pacific States Electric Company in the sales department.

W. R. Marshall has been made branch manager of the Buffalo sales office of the Westinghouse Electric & Manufacturing Company. Mr. Marshall has been a division manager connected with the New York office. C. W. Underwood, who was Buffalo branch manager, has been made Northern representative.

Graeme Ross has been appointed manager of the Kansas City branch office of the Westinghouse Electric & Manufacturing Company to succeed F. F. Rossman, who has resigned to accept the position of vice-president of the Mobile (Ala.) Light & Railway Company.

Allen B. Coffman has resigned as sales engineer for the Crouse-Hinds Company to become manager of the Philadelphia district of the Reliance Electric & Engineering Company, Cleveland, manufacturer of electric motors. In the past three years, while connected with the Crouse-Hinds Company, Mr. Coffman has made a study of different types of electrical installations in various industries from Pennsylvania to Florida. He will continue to make his headquarters in Philadelphia.

C. J. Snyder Goes to Duluth

Carl J. Snyder has resigned as chief engineer of the Nebraska Power Company at Omaha to become manager of the commercial service department of the Duluth Edison Electric Company. Mr. Snyder was graduated in electrical engineering from the Iowa State College at Ames in 1909 and has been associated with the Nebraska Power Company in construction, operation and engineering work since that date. Under his

C. J. SNYDER

direction the duties of the engineering department have been expanded to include phases of utility operation not usually handled by that department. This work includes the issuing of all plans, estimates and orders for all construction resulting from customers' applications for service and also all property accounting records. Mr. Snyder has taken an active part in the work of several of the technical committees of the National Electric Light Association and at present is vice-chairman of the Middle West Division Technical Section.

E. S. Fitz, formerly general superintendent of the Houghton County Electric Light Company, Houghton, Mich., is now engineer in the power-station betterment division of Stone & Webster, Inc., Boston.

Otto E. Huebner, who had been associated with the New York & Queens Electric Light & Power Company for three and a half years, has resigned to manage the Exide Battery Service station in Flushing, L. I.

A. L. Schieber, formerly manager of the generator section of the power department of the Westinghouse Electric & Manufacturing Company, has been appointed to the recently created position of export representative of that department. Mr. Schieber is well fitted for the position, since in connection with his former duties he had considerable contact with foreign work. He will be succeeded as manager of the generator section by Willard Lofton, who for some time has been in active charge of the work of that section under Mr. Schieber's direction.

O. H. Eschholz, design and development engineer for the Westinghouse Electric & Manufacturing Company since 1910, has been appointed general manager of the Pittsburgh Chemical Company. Of late years Mr. Eschholz has devoted much time to research and the investigation of vapor arcs, electron emission, rectification, arc welding, precipitation, arc-rupture phenomena and breaker construction. He has also to his credit special achievement in the development of direct-current interpole generators, welding apparatus and processes and electrostatic precipitation apparatus and processes and has contributed widely to the electrical press.

E. A. Hawkins, vice-president and general manager of the Webster Electric Company, Racine, Wis., since 1919, has resigned his position and on May 1 assumed the duties of manager of the telephone and appliance departments in the general sales department of the Western Electric Company at its headquarters in New York City. Mr. Hawkins was with the Western Electric Company for nineteen years before going to Racine. He will direct the manufacture and sale of appliances manufactured by other concerns for the Western Electric Company and before going to New York will visit a number of factories in the Middle West which are under contract with the Western Electric Company. His successor at Racine has not been named.

Obituary

John Gilbert Ward, treasurer of the Babcock & Wilcox Company, died in New York City on Sunday, April 22.

Randolph Troy, manager of transformer specialty sales of the merchandise department of the General Electric Company, died of pneumonia in the House of Mercy Hospital, Pittsfield, Mass., April 26, after an illness of three days. Mr. Troy had been associated with the General Electric Company since 1906, and when the merchandise department was organized last year he was assigned to the position he occupied at the time of his death.

Donald Strode Barton, formerly general manager of the Canadian Electric Light Company, Levis, and consulting engineer of the Quebec Railway, Light, Heat & Power Company, is dead. Mr. Barton was born in India and was educated in England. He went to Canada in 1900. He settled in Montreal and practiced his profession there for five years, when he accepted an appointment as general manager of the Canadian Electric Light Company and at the same time became consulting engineer of the Quebec Railway. When the Levis company was absorbed by the Quebec Railway he remained with the company in the capacity of consulting engineer.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Metric System in Electrical Industry

Although Manufacturers Would Share Inconvenience of Change, They Would Share Also in Benefits—Present Conflict with Other Countries Over Measurements

By Burt L. Newkirk
Research Laboratory, General Electric Company, Schenectady, N. Y.

THE electrical industry now uses metric units for electrical quantities, but the dimensions of the motors, generators, turbines and other apparatus necessary to the production, control or utilization of electrical energy are designed and manufactured to inch and foot dimensions. The metric system of weights and measures is the fundamental standard in the United States. The law of 1866 legalized the use of the metric units and established a table of equivalents between metric and American measures of length, capacity, area and weight. In 1893 "the Superintendent of Weights and Measures, with the approval of the Secretary of the Treasury, decided that the international meter and kilogram would in the future be regarded as the fundamental standards of length and mass in the United States, both for metric and customary weights and measures." When the Bureau of Standards was established in July, 1901, this decision, made in 1893 by the Bureau of Weights and Measures, was accepted. Thus by law and by action of the Government bureaus the metric weights and measures have legal standing and authority as the fundamental units.

Background of Metric System

These standards are made with great care, of materials that, to the best of our knowledge, will not change. They are so fortified by the existence of other copies of the international meter and kilogram, distributed throughout the world, that irreparable loss of the standards is not to be feared. The International Bureau of Weights and Measures is maintained by seventeen countries for the care and preservation of these standards and the periodic intercomparison of the same. I think no informed person would claim that any other standards compare with those of the metric system in satisfying the requirements of a fundamental standard.

The metric system was devised and adopted in France during the French Revolution, when radical reforms were the order of the day. It was adopted in Germany at the time of achievement of national unity and in Italy under similar circumstances. The countries of South America adopted the metric system in the early stages of their national development. Japan has recently taken similar action, and it is reported that Russia and the new nations which were formerly part of Russia have done likewise.

In the United States the avoirdupois pound and the inch are pretty well intrenched in industry and in the life of the people. These are defined by federal law and so are standard throughout the land. There is also practical agreement with the British Empire on these units. The measures of capacity—that is, gallons—are not identical, the British Imperial gallon being 20 per cent larger than the United States gallon of 231 cu.in. Much pressure is being brought to bear on both sides of the water in favor of a change to the metric system, but so far without entire success. The reasons are not far to seek. The chaos in the old standards that impelled the French, Germans and Italians to change does not exist here or in Britain, and our pound, foot and gallon are deeply rooted in our industrial and civil life.

Alarm Is Unjustified

The alarm with which some manufacturers view the prospect of changing to the metric system seems unjustified. A few firms in this country are now doing their manufacturing essentially on a metric basis. Many firms are serving their export trade with goods made to metric dimensions. There is probably some embarrassment in getting stock, tools, etc., to metric dimensions, but if this entailed much loss of money it is not likely that these firms would continue their allegiance to the system.

The change can be made in the drafting room without delay or serious inconvenience. The fundamental gages are re-etched, but the product is not changed in any dimension; consequently the production gages are not changed. New designs are laid out to metric dimensions and the draftsmen, tool makers and shop foreman must know how to read blueprints and to measure lengths in millimeters, but even this is not required of the operator of a production machine. Either metric or American drills, taps, dies, etc., may be used. Gages become obsolete and tools wear out and these can be replaced to keep pace with any gradual process of change to a new system. That any considerable proportion of the machine tools now in operation in this country would be scrapped in changing to a metric basis does not seem to me to be at all probable.

Ultimate Yield to System

If our manufacturers were persuaded of the desirability of changing, they would do it easily and without serious loss to themselves. In fact, many of them are now manufacturing to metric dimensions for the export trade, and no one has claimed, I think, that these metric goods cost much, if any, more to produce than the standard product. Various circumstances other than the demands of export trade are working to introduce the metric system into American industry. Among these may be mentioned the influence of science upon industry, the operation of international affiliations and the prospect of world standardization in particular manufacturing specialties.

In spite of the intrenchment of the

inch, pound and gallon in industry and in the common life of a very aggressive race, they must ultimately yield to the metric system. The latter is universally accepted and used in science; the electrical units are metric; new industries, as, for example, the manufacture of ball bearings, are building up on the metric basis, and apparently an overwhelming majority of the world's population is getting into line on the metric side. In Great Britain and the United States merchants, boards of trade, statesmen, educators and business men appreciate the advantages of the metric system and favor its adoption. The opposition centers about the difficulty of changing such fundamental things as screw-thread spacings and other dimensions that have become standard. In my opinion, however, the adoption of the metric system does not involve necessarily changing screw-thread spacings or shapes, wire gages, sheet-metal gages, etc.

We should undoubtedly continue to designate nails as sixpenny, tenpenny, etc., because at one time some nails sold six for a penny and others ten for a penny. In a similar way a metric world may accept our Brown & Sharpe wire gage or our United States standard screw threads, or it may choose to standardize wire sizes and screw threads devised on a basis of metric dimensions. But metricists, in my opinion, are under no obligation to convince the public that these things, deeply rooted in American industry, ought to be changed as part of a metric program. Their burden is to show that the metric system should be made the dominant one and to outline a program adequate to accomplish this with the minimum inconvenience and expense to the country. The extent to which present manufacturing practice should be modified to adjust itself most economically to the metric basis would then be worked out in detail with much care and study of each step, but future developments would build up naturally on the new basis. New industrial projects would reap the advantage of an interrelated set of units common throughout the world.

The Insecurity of "High-Price" Business*

Country's Progress Stops When Business Is Gained Too Easily—High Prices at Home Create Indifference Toward Exports

BY EDWARD N. HURLEY
Chairman of the Board,
Hurley Washing Machine Company

WHAT incentive or necessity do men have to decrease costs and increase their efficiency if their margin of profits is abnormally high? There is danger in war profits, danger in after-war profits, danger in the feeling that there is no competitor in the world worth fearing. Men say, "What is the use of trying to increase our profits by economy when we can get the prices we ask?"

The pioneers in American industry won their success by fighting hard for business. It was a sporting proposition and the best man won in obtaining the order. If, by a combination of circumstances, this American fighting spirit is to be allayed and we obtain business easily and at high prices, it is only a question of time before business executives become inefficient, and inefficient management produces inefficient workmen. This would seriously affect the progress of our country.

DANGER IN OVERCONFIDENCE

Sometimes I think we are too cocksure of our efficiency and think we know it all. Most of us have really been lucky instead of efficient, and we must not think that large profits are always an indication of efficiency.

Germany had the feeling in 1914 that she was 100 per cent efficient in all things, but the many lessons she learned during and since the war may be a great blessing to her future economic development. Our country, swinging into a constantly developing period of improvement in most of our principal industries, and with some very sharp lessons of our own gained during the post-war period, most certainly should not let slip her golden opportunity to build an enduring and all-inclusive prosperity.

Foreign trade also requires some of the old American clipper-ship fighting spirit, and the exporters and their salesmen who are blazing the trail, selling American goods in the markets of the world, should be on our country's roll of honor, particularly when they not only have the difficulty of obtaining business for export, but in addition have the hard task of keeping American manufacturers sufficiently interested to fill export orders.

LESSON OF PRICE BOYCOTT

American orders at home are being obtained without very much effort and in many cases at high prices. These high prices on domestic orders frequently create indifference toward foreign trade, seriously affecting our merchant marine and our country at a period when we need exports to balance our increasing imports.

The American housewives bought and hoarded sugar in 1919, resulting in a great scarcity and causing abnormally high prices. Manufacturers and merchants did the same in 1920 in hoarding materials, thus creating a shortage and causing untold losses of millions to them and to the country. This lesson must not be forgotten, and the fact that prices are higher should not encourage us to borrow money to again selfishly hoard surplus materials.

I believe in the ability and the integrity of the American business man, but I do not think he is putting forth that effort to reduce the cost of manufacturing and selling his wares that he is capable of doing. What might be termed post-war necessity is now ignored by most of us. The war produced high prices and abnormal profits from the effect of which we have not recovered.

COST REDUCTION VITAL

A reduction in costs of manufacturing and the employment of every inch of floor space in every factory were never so much needed. Some concerns, through a combination of circumstances, have been able to make profits without doing this. They must, however, soon fall into line. Industrial building should be kept at a minimum. Let the employees do the building, so that they may have their own homes—another feature of real prosperity.

War and war profits retarded the progress and natural development of our country. There must be a readjustment. While many of us urge

*An address given before the second general session of the Tenth National Foreign Trade Convention, New Orleans, May 3, 1923.

the readjustment of labor as a remedy, management must also be readjusted to meet new conditions. Labor can become more efficient—so can management. Unless we improve our methods so as to increase our profits by lowering our costs of manufacturing and selling and adding to our list of customers foreign purchasers, we are not working on a sound basis. Now is emphatically the time to avoid the errors of 1920, to keep a sane attitude toward industry, to be satisfied with a production schedule that fairly meets the demand but falls short of overproduction—and to increase profits not by increasing prices, but by reducing costs of the business we are already enjoying.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

Chicago Business Generally Is Very Active

THE electrical trade again reports very good business for the past week. Several advances in price were also announced. Motors have advanced approximately 4 to 6 per cent. One company changed some of its slip-ring types from a 50-deg. to a 40-deg. rating. Control apparatus advanced ten per cent and a general revision of list prices was announced. In some cases these lists were reduced or equalized, while in others they were advanced. The same was true of motors. Western red-cedar poles advanced 10 to 18 per cent, while the condition of stocks has not changed at this time.

Building permits exceeded those issued last year by about thirty permits, while the amount of money involved exceeded that of last year by approximately a million dollars. Conduit stocks are still low.

Prices of Lamps Are Now Below Pre-War Level

IN VIEW of the fact that incandescent lamps are the most frequent points of contact electrical stores have with their customers, and, particularly, since every user of electricity is a buyer of lamps, it is interesting to review here the trend of prices of incandescent lamps during the past few years.

Because of improvements in manufacturing methods, in spite of the rising costs of material and labor, increases in lamp prices during the war-time period were small compared with those that took place with other commodities. In the face of generally increasing prices in commodities at the present time, it is interesting to note that these recent changes bring the prices of lamps below the pre-war level on both vacuum and gas-filled types, and in the case of the gas-filled lamp these prices are the lowest in the history of the industry.

The reduction just made is the third since April 1, 1922, when there was a readjustment in which "Mazda C" lamps were reduced about 5 per cent and "Mazda B" lamps on an average 12½ per cent. On Oct. 1, 1922, a reduction was made in the prices of "Mazda C" lamps which averaged about 20 per cent.

Size of Lamp (Watts)	Jan. 1, 1922	April 1, 1922	Oct. 1, 1922	May 1, 1923
		"Mazda B"		
10-50	$0.40	$0.35	$0.35	$0.32
60	0.45	0.40	0.40	0.37
		"Mazda C"		
50	.60	.55	.55	.50
75	.70	.70	.60	.55
100	1.00	.95	.75	.70
150	1.40	1.30	1.00	.90
200	1.90	1.80	1.30	1.15
300	2.80	2.50	1.90	1.75
500	4.15	3.75	2.75	2.50
750	5.75	5.25	4.00	3.75
1,000	6.70	6.00	4.50	4.25

The accompanying table shows Mazda lamp prices at important points during the last few years.

Business in New England Continues at Full Tide

BUSINESS continues at full tide, the pressure for wage inflation being the most active disturbing factor for the time being. The expansion of central-station plants continues to astonish investors, and the demand for service is reflected in the success of widespread house-wiring campaigns and increasing purchases of electrical material by industrial and mercantile establishments. Last week's falling prices of securities and the weakening tendency of some raw materials has caused slowing down of commitments to far-reaching projects, but on the whole the New England States are sharing in the great production volume common to other sections of the country.

Retail business is improving with better weather, but in northern New England trade has been much upset temporarily by floods now fast subsiding. An epochal announcement in generating-plant plans was made at Boston last week in connection with the proposed use of 1,200 lb. steam pressure at the Weymouth station of the Edison Electric Illuminating Company, and it is noteworthy that this same pressure is being considered for some other contemplated plant construction in Massachusetts.

The effect of such announcements upon the sale of plant engineering equipment is not easily measured as regards future marketing of boilers and accessory machinery, but this and new high-tension line and switch-house construction proposed or under way in Massachusetts have a trade reaction of considerable interest.

Building contracts in New England for the week ended May 1 were the largest for this week in twenty-three years, a total of $8,942,900. Jobbers of electrical material report some improvement in transportation conditions and also some shortening of deliveries. Lamp prices were reduced from list about 8 per cent last week, and cotton, copper, rubber, steel and lead display weakness on current quotations. Stocks of Boston jobbers were well-rounded Monday, buying being well sustained.

Appliance Sales Respond to Improved Merchandising Methods

REPORTS of appliance sales from week to week indicate increasing interest on the part of the public in labor-saving devices for the home, the larger equipment being in unusually active demand. In some quarters sales of washers, cleaners and refrigerating apparatus during the last few weeks have picked up rapidly. One Eastern central-station company sold 100 washers during April, and in the same territory the demand for cleaners revived to a gross well above the preceding month.

Portable lamps are moving faster than is normal for this season. Stocks of fans are being laid in against the anticipated early summer demand. Popular appreciation of moderate-priced devices like waffle irons, toasters and small disk heaters is encouraging, and one central-station exhausted its stock of the former soon after the beginning of a special campaign which offered nine-dollar units on the basis of $1 down and easy time payments. The relation between appliance sales

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.034	$0.0322	$0.0236
Cold finished shafting, per lb.	0.042	0.0406	0.032
Brass rods, per lb.	0.1913	0.1913	0.15
Solder (half and half), per lb.	0.2987	0.314	0.21
Cotton waste, per lb.	0.1231	0.1231	0.104
Washers, cast iron (¼-in.), per 100 lb.	4.66	4.50	4.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	2.96	2.96	3.11
Machine oil, per gal.	0.349	0.349	0.40
Belting, leather, medium, off list	42%	42%	48½%
Machine bolts, up to 1-in. x 30-in., off list	44½%	48½%	62½%

and prices is interesting managers of retail departments keenly at this time. The opinion was expressed to a representative of the ELECTRICAL WORLD recently that if manufacturers of appliances can build business on the basis of increased sales volume and a moderate profit per unit marketed, the public will "stay with" the industry as a continuous and expanding purchaser.

The point was made that appliance prices have in many cases been reduced materially during the past two or three years; that the public has responded to these reductions, and that the utmost effort to develop quantity business and to absorb cost increases if possible in expanding gross sales will prove the best policy. Some significance attaches to the fact that the upward pressure of costs has thus far been widely resisted by manufacturers. The outlook continues excellent for appliance sales throughout an immense range of types, designs and prices.

Better Advertising Must Be Used to Get Foreign Trade

IN A COMPREHENSIVE survey of advertising for the electrical export field, G. Grenville Hunter of the International General Electric Company, Inc., told the tenth national foreign trade convention at New Orleans that there is no specter to intimidate or deter American traders from securing their share of profits from overseas markets, provided the right kind of publicity is used.

"You must remember," said Mr. Hunter, "that in foreign advertising you must take dealer representation as you find it—some of it good, most of it bad. You must direct your advertising toward making these dealers better merchants of your particular product through the medium of your advertising, which plays a definite part in making people want what your dealers sell; then selling them what they want in a way that will make them want more. Any advertising material which you send out will be of little value unless it is made of value by the dealers who use it. It will be of greatest value when these dealers are taught how to use it, and this is the first fundamental step in moving your goods from the dealer's shelf into the customer's hands.

"'Americanism' must be avoided at all costs because, while it is true that merchandising development in the United States has reached a stage in advance of many countries, nevertheless in using our experience as a cri-

Exports of Wiring Devices, Meters, Motors, Rheostats, Fans, Motor-Driven

		Sockets, Outlets and Receptacles		Other Wiring Supplies and Fixtures		Watt-Hour and Other Measuring Meters		Volt, Watt and Ampere Meters and Other Recording, Indicating and Testing Apparatus		Motors Under 1 Hp.		Stationary Motors				Railway Motors	
												1 to 200 Hp.		Over 200 Hp.			
		No.	Dollars	Pounds	Dollars	No.	Dollars	No.	Dollars	No.	Dollars	No.	Dollars	No.	Dollars	No.	Dollars
1	Azores	150	40					1	149								
2	Belgium	80,935	15,303	7,803	7,705	203	4,741	2,185	10,895	127	2,159	285	30,727	64	31,599		
3	France	5,576	1,948	21,472	16,792	58	1,180	409	8,510	1,801	11,173	137	27,725	2	7,127		
4	Denmark	6,300	935	2,629	1,402	32	724	229	5,703	3	377						
5	Greece			267	252			2	142	4	329	17	1,185				
6	Iceland & Faroe Islands									5	108						
7	Netherlands	8,343	3,032	5,450	2,679	51	1,273	437	7,617	1,088	19,639	74	1,934				
8	Norway	3,330	1,561	24,318	7,125	11	1,124	153	3,759	89	2,172	4	1,120				
9	Spain	82,871	10,014	9,402	5,077	1,145	9,267	175	7,758	1,134	30,333	344	57,941			6	8,17
10	Sweden	536	620	672	1,489	102	463	95	2,878	18	1,291	22	1,440	1	620		
11	Switzerland	4,000	1,135	2,288	1,587			53	5,970	92	1,182	24	336				
12	England	45,746	10,674	101,261	96,193	999	22,124	9,496	63,835	2,489	55,473	1,179	76,990	2	3,600	10	13,1
13	Scotland	1,750	700	24	21	4	325	4	810	14,815	162,620	998	20,737				
	Canada:																
14	Maritime Provinces	3,381	3,358	28,084	13,070	28	682	149	3,634	58	1,684	72	9,014	1	600	1	9
15	Quebec and Ontario	335,096	90,416	1,116,660	448,235	9,710	58,518	29,920	105,157	14,909	223,122	4,346	392,588	20	6,700	46	79,2
16	Prairie Provinces	24,837	5,149	50,078	25,666	222	1,947	564	6,856	428	9,983	298	31,222				
17	British Columbia and Yukon	19,189	3,107	40,776	19,473	22	1,570	105	1,749	205	5,790	175	37,291	4	8,480		
18	British Honduras	1,382	451	7,235	1,788	152	1,729	28	61	5	313	18	3,072				
19	Costa Rica	3,532	1,038	2,139	884			4	254	41	1,166	2	661	1	1,400		
20	Guatamela	2,406	734	3,804	3,051	427	102	49	582	10	286	16	1,642				
21	Honduras	8,618	2,221	30,561	7,589	189	2,266	37	551	19	514	34	4,622				
22	Nicaragua	1,416	238	8,207	2,142	2	45	32	435			7	4,548				
23	Panama	10,699	2,225	16,324	10,450	2,017	18,673	247	1,402	34	1,140	24	3,043				
24	Salvador	3,939	1,194	2,764	1,564			30	807	45	832	20	1,811				
25	Mexico	239,921	33,608	188,604	90,530	11,375	92,696	2,224	35,968	884	20,775	1,087	138,165	39	24,943	39	7,3
26	Newfoundland & Labrador	1,594	418	26,915	4,672	219	1,338	396	4,714	34	1,031	21	5,132				
27	Bermuda	175	40	27,560	12,075	63	4,416	37	2,800	32	1,272	4	202				
28	Jamaica	2,710	679	2,585	945	431	4,359	36	975	1	44	20	4,893				
29	Trinidad and Tobago	3,258	733	12,904	4,753	175	1,857	362	5,684	29	723	10	867	2	1,190		
30	Other British West Indies	4,484	519	27,608	15,751	27	670	110	1,227	33	1,991	52	16,877	2	1,190		
31	Cuba	107,173	19,554	193,796	77,249	5,241	51,701	1,156	16,984	470	14,994	311	95,999	12	13,826		
32	Dominican Republic	1,976	272	7,949	6,653	1,865	112	55	1,865	1	28	7	938			6	6
33	Dutch West Indies	443	109	4,237	2,044			1	25	1	8						
34	French West Indies			28	31												
35	Haiti	1,605	403	17,056	4,141	114	1,080	8	425	3	208	6	521				
36	Argentina	373,018	83,722	57,690	40,927	1,494	13,356	1,019	12,284	617	19,267	345	43,332	3	1,864		
37	Brazil	320,475	60,433	215,472	72,393	6,944	52,121	1,215	23,984	399	7,510	203	65,725	22	64,396	62	42,7
38	Colombia	31,600	6,600	24,508	9,717	191	2,668	327	2,566	73	2,332	129	21,992	3	2,450		
39	Ecuador	13,677	1,548	16,742	2,702	129	977	5	124	8	311	12	2,914	1	680		
40	Bolivia	1,000	300	2,308	1,247	7	290	37	2,361	2	38	16	11,331				
41	Chile	12,927	4,170	77,269	14,879	31	1,283	192	5,735	35	1,315	521	65,234	6	19,571	7	5,6
42	Peru	13,298	3,780	12,904	7,555	75	1,724	55	1,592	107	2,806	65	16,036	4	29,001		
43	Venezuela	28,354	5,133	19,002	7,831	27	570	216	1,449	29	1,323	249	10,303				
44	Hongkong	750	220	6,579	2,452	3,216	22,680	722	4,934	5	280	109	10,242				
45	Japan	43,489	16,371	216,199	73,657	2,055	55,246	10,655	371,366	3,046	69,796	1,646	288,618	147	228,308	360	225,0
46	British India	3,939	1,419	45,087	12,649	294	4,833	1,196	7,484	240	7,003	221	39,754	54	80,964		
47	China	158,358	10,803	91,268	50,553	6,600	48,072	1,190	22,322	289	10,508	627	123,866	3	2,587		
48	Philippine Islands	40,488	12,503	32,880	22,344	1,923	18,186	917	16,010	58	2,247	278	43,164	4	20,449		
49	Siam	550	245	1,341	805			14	305	18	1,256	12	932				
50	British West Africa	560	97			300	2,730	16	171			1	78				
51	British South Africa	8,706	2,923	14,315	6,330	127	2,079	390	7,396	53	2,294	248	49,590	18	12,798		
52	Australia	125,039	46,216	114,019	69,914	465	9,266	3,697	39,177	1,467	46,140	1,905	163,869	63	83,095	1	5
53	Dutch Guiana																
54	Turkey in Europe			2,266	961							1	110				
55	New Zealand	21,468	9,128	31,552	15,412	4,289	29,209	707	8,995	408	10,117	332	29,914	38	15,823		
56	Italy	1,800	1,257	29,195	8,865	110	1,099	1,125	7,043	198	3,369	20	1,281				

terion we must be exceedingly careful to show ourselves friends rather than shining examples of Yankee efficiency."

Referring to the participation of American shippers in fairs and exhibits abroad, Mr. Hunter stressed the importance of sending the right type of representative. Much damage has been done—and is still being done—to our foreign trade by the "fresh" type of Yankee salesman, with whom the foreigner will have nothing to do.

The Ruhr Occupation and the Electric Industry

OCCUPATION of the Ruhr has not as yet made itself felt in the German electrotechnical industry, says Dr. Carl Friedrich von Siemens, chairman of the board of the Siemens & Halske Aktien-Gesellschaft, in his annual report under date of March 22. Extracts from the report, translated by the Department of Commerce, are as follows:

"No reduction in unproductive expenses was possible. Instead there was an increase. Prospects of improvement are poor at this time. Drafts of new laws and regulations promise to place further obstacles in the path of orderly economic development. One soon will be able to speak of Germany as a wonderfully well-organized country theoretically but one in which practical life is extremely difficult.

"New orders are decreasing considerably, largely because of the appreciation of the mark and the hope of further price reductions. This is the countermovement in speculation. Reduction of prices for electrotechnical products is not prevented by a desire to sell at prices which will cover the costs of materials purchased at higher prices than those which obtain today, but is made impossible by the prevailing high costs of material, by high wages and by greatly increased overhead expense. If we do not succeed in bringing down these expenses to their former level and in increasing production, and, further, if we are unable to pay satisfactory returns upon invested capital and to bring down prices to the world level at least, it will be impossible longer to maintain German industry."

The Metal Market

Demand for copper during the past week has been very slow. Sellers and consumers seemed to be sparring and waiting for developments during the greater part of the period, but in the

...ousehold Devices, etc., from the United States During 1922

(Original data supplied by the Bureau of Foreign and Domestic Commerce.)

...rs (N. F. S.)		Rheostats, Controllers and Other Starting and Controlling Equipment		Accessories and Parts for Motors		Electric Fans		Motor-Driven Household Devices		Domestic Heating and Furnaces, Cooking Devices and Ovens				
No.	Dollars	Pounds	Dollars	Pounds	Dollars	No.	Dollars	No.	Dollars	No.	Dollars	No.	Dollars	
.....	.....	.....	.....	20	35	.....	.....	.....	.....	12	45	.....	.....	Azores
58	5,348	48,233	7,111	32,966	15,567	83	1,447	1,327	31,798	11	298	3	578	Belgium
134	6,737	89,927	61,033	102,013	72,770	402	2,531	1,482	20,729	218	1,334	5	672	France
77	21,292	184	245	174	427	.....	.....	113	3,807	83	1,160	.....	.....	Denmark
.....	.....	.....	.....	39,710	13,320	2	87	1	78	50	325	.....	.....	Greece
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Iceland & Faroe Islands
.....	.....	467	168	688	738	.....	.....	3,813	97,891	604	5,102	2	695	Netherlands
3	94	62	47	3,429	2,731	.....	.....	184	5,438	4,882	4,910	1	46	Norway
55	3,538	60,454	30,044	40,320	17,255	7,263	7,263	1,767	3,340	1,840	6,745	1	11,000	Spain
11	445	822	1,480	1,062	1,488	1,228	1,228	9	955	.....	.....	.....	.....	Sweden
1	50	.....	.....	263	245	.....	.....	862	22,154	482	434	.....	.....	Switzerland
103	11,368	68,562	32,334	90,882	61,592	54,871	54,871	4,064	100,953	20,455	66,414	38	36,832	England
72	11,003	13	25	6,515	12,270	18,494	18,494	348	2,352	942	3,455	1	107	Scotland
20	443	8,751	6,465	6,713	3,727	536	536	158	3,981	411	1,982	1	25	Canada: Maritime Provinces
448	116,829	316,089	191,850	239,420	124,476	113,460	113,460	39,516	1,250,802	58,493	99,020	189	9,949	Quebec and Ontario
45	3,269	11,655	7,206	25,301	14,256	15,695	15,695	1,482	30,152	3,780	12,272	12	452	Prairie Provinces
39	989	6,855	3,828	14,332	8,812	161	2,220	1,017	18,276	3,353	7,776	10	5,703	British Columbia and Yukon
7	5,041	61	29	2,160	4,004	59	1,298	4	109	151	934	.....	.....	British Honduras
3	55	390	253	8,574	6,084	9	208	4	198	43	566	1	11	Costa Rica
2	192	182	97	970	900	8	125	1	.....	736	1,799	1	412	Guatemala
17	6,502	636	831	4,750	6,814	88	2,129	8	451	285	2,364	.....	.....	Honduras
.....	.....	1,046	290	909	1,205	.....	.....	2	16	17	45	5	250	Nicaragua
3	305	3,892	1,370	2,755	2,266	61	1,094	377	276	1,087	5,642	1	55	Panama
.....	.....	632	359	272	242	68	694	33	413	94	879	.....	.....	Salvador
373	25,133	96,540	40,027	130,713	72,161	2,015	36,840	373	6,607	8,638	42,538	25	18,024	Mexico
1	62	148	80	4,242	3,420	4	65	8	255	49,026	2,244	.....	.....	Newfoundland & Labrador
5	45	215	115	558	156	47	1,463	10	567	99	819	1	28	Bermuda
3	1,374	5,157	2,145	9,815	2,300	39	823	6	79	15	170	.....	.....	Jamaica
3	85	336	226	15,267	5,350	43	524	3	66	147	573	.....	.....	Trinidad and Tobago
2	220	626	221	660	695	26	924	7	72	25	1,247	.....	.....	Other British West Indies
36	4,659	106,285	47,538	134,036	83,611	410	7,465	114	2,269	2,324	12,890	15	793	Cuba
.....	.....	674	463	7,640	8,050	14	380	4	500	5	19	.....	.....	Dominican Republic
.....	.....	.....	.....	153	122	.....	.....	.....	.....	.....	.....	636	330	Dutch West Indies
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	6	.....	.....	French West Indies
.....	.....	187	117	.....	.....	28	276	1	68	12	99	1	8	Haiti
164	13,707	4,357	2,286	26,990	15,001	1,848	34,408	776	4,662	7,806	862,974	8	915	Argentina
65	13,822	46,213	13,315	117,946	48,627	367	.....	5,811	1,206	1,861	6,160	7,384	2,600	Brazil
11	751	2,840	1,574	29,540	14,900	395	8,622	25	708	432	2,170	.....	.....	Colombia
.....	.....	1,420	505	2,181	803	30	1,293	.....	.....	41	271	.....	.....	Ecuador
3	741	114	48	8,855	7,157	.....	.....	.....	.....	2	35	2	137	Bolivia
1	320	24,725	12,160	81,662	35,312	113	1,754	18	748	291	1,638	6	1,078	Chile
1	304	6,179	3,648	38,107	24,736	19	619	113	1,853	538	2,141	2	2,341	Peru
12	1,420	2,192	966	6,941	3,661	185	2,226	47	644	570	2,654	.....	.....	Venezuela
2	81	1,761	961	975	842	1,417	29,384	144	1,001	1,100	4,790	.....	.....	Hongkong
157	12,165	425,777	169,703	149,829	69,855	3,176	47,642	753	40,864	9,479	60,345	508	63,828	Japan
103	40,915	114,858	42,800	223,806	74,339	6,622	144,665	77,016	4,644	1,225	4,088	927	2,860	British India
188	7,092	13,095	4,637	45,994	19,737	5,516	108,565	7,223	4,692	6,263	10,360	2,090	32,118	China
5	641	4,724	4,266	16,661	8,966	407	12,061	148	820	3,365	13,442	5	508	Philippine Islands
.....	.....	.....	.....	3,101	1,989	587	11,436	.....	.....	15	216	.....	.....	Siam
.....	.....	.....	.....	80	20	.....	.....	.....	.....	.....	.....	.....	.....	British West Africa
707	35,741	29,724	11,369	37,358	17,856	496	4,184	58	1,919	5,341	23,174	25	435	British South Africa
.....	.....	82,575	28,541	210,864	106,105	2,979	47,851	2,208	30,690	10,490	44,312	8,326	50,014	Australia
.....	.....	.....	.....	1,123	1,088	.....	.....	.....	.....	.....	.....	.....	.....	Dutch Guiana
99	11,370	6,723	2,747	2,501	504	.....	.....	.....	.....	.....	.....	.....	.....	Turkey in Europe
.....	.....	.....	.....	17,548	9,358	136	3,004	314	6,608	6,420	28,517	15	2,025	New Zealand
2	59	30,341	11,616	2,564	1,810	1,709	16,490	746	21,529	218	1,704	4	336	Italy

NEW YORK METAL MARKET PRICES

	May 2, 1923 Cents per Pound	May 9, 1923 Cents per Pound
Copper, electrolytic	16.75 to 17.00	11.50 to 16.62½
Lead, Am. S. & R. price	8.00	8.00
Antimony	8.00 to 8.25	8.00 to 8.25
Nickel, ingot	28.00–30.00	28.00 to 30.00
Zinc, spot	7.37½	7.37½
Tin, Straits	45.00	45.00
Aluminum, 98 to 99 per cent.	26.00	26.00

end it was stated that inquiries were slightly better.

Reports were circulated that one of the first hands had been offering copper at 16.37½ cents per pound, but this was emphatically denied in well-informed trade quarters, and an investigation among the sellers does not confirm the rumor. As a matter of fact, the big interests held for 16.62½ cents per pound, which appeared to be the low point on copper delivered at the plants of the consumer.

One or two sales actually were made at 16.50 cents per pound, but these transactions were exceptional, because they did not involve any delivery charges to speak of and were practically f.o.b. New York, or the equivalent of at least 16.62½ cents per pound delivered at the consuming point on ordinary transactions.

Second hands and those handling resales of the metal continued to shade prices and give concessions under the quotations of the big interests, but this is to be expected in a market such as has been experienced in the past few weeks. It is possible that one of these offered the metal at 16.37½ cents during the week, but even this could not be confirmed.

That there is a big demand for copper to come into the market is the popular opinion among the best posted authorities. Few of the sellers have been willing to dispose of the metal beyond July delivery, and as a result of that attitude the consumers have but small supplies of the metal on hand for their future needs.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Plainville to Assemble Trumbull-Vanderpoel Inclosed Switch Parts

The growth of the inclosed-switch business of the Trumbull-Vanderpoel Company, Bantam, Conn., has led to an agreement with the Plainville (Conn.) Electrical Products Company whereby the latter will assemble and market this portion of the Bantam company's output. The Trumbull-Vanderpoel Company will continue to manufacture inclosed knife switches, safety switches, meter switches and the Mason safety switch for line service.

Twenty-two Makers and Agents at New York Cleaner Show

Twenty-two manufacturers and agents of vacuum cleaners have accepted the New York Edison Company's invitation to exhibit standard makes and different types in the Irving Place showroom May 14 to 19. Electric scrubbing and polishing machines will be shown.

Calorizing Company Formed by General Electric Interests

The Calorizing Company has been incorporated under the laws of Delaware to take over the assets and business of the Calorizing Company of Pittsburgh, which has developed commercially a heat-treating process originated by the General Electric Company, by which aluminum is driven into the surface of metals, thereby greatly increasing their resistance to high temperatures and to certain corrosive reactions. The new company, with headquarters in Pittsburgh, has an authorized capital of 30,000 shares of 8 per cent cumulative convertible stock at $25 par value and 100,000 shares of common stock at no par value. The General Electric Company owns 25 per cent of the common stock.

Walker Electric Vehicle Opens Atlanta Branch Office

The Walker Vehicle Company, Chicago, manufacturer of Walker balance-drive electric trucks for city routes, has opened a branch office in Atlanta. P. C. Pomeroy, who has had extensive experience in trucking matters while representing the White and Packard organizations, has been appointed district manager, with offices at 926 Hurt Building, Atlanta.

Brisk Fan Business for the Emerson Electric Company

The Emerson Electric Company, St. Louis, reports large orders for fans from the South and Southwest. Building activities in Texas are responsible for a number of very large orders for future delivery. There is every indication that this will be a banner fan season, notwithstanding the fact that it has been a rather cool spring. Jobbers and retail dealers in all parts of the country have had their stocks depleted and are ordering for immediate delivery. It is interesting to note the unusual number of orders that have recently been received for 32-volt fans for use with farm-lighting outfits, which is a natural reflection of the present activity in farm-lighting plants.

Denver and Butte Jobbers Hold Joint Sales Convention

The Capital Electric Company, Salt Lake City, Western distributor of General Electric products, and the Butte Electric Supply Company of Butte, Mont., held a joint sales convention on May 3 and 4. H. D. Randall of the General Electric Company delivered a lecture on the outlook for the rest of 1923.

Forty salesmen attended the convention. Encouraging reports were brought from various points of the intermountain territory. J. A. Kahn, president of the Capital Electric Company, was in charge of the convention.

Westinghouse Receives $1,000,000 Order from West Penn Power

The West Penn Power Company has placed with the Westinghouse Electric & Manufacturing Company an order amounting to more than $1,000,000. The contract includes seven 12,000-kva., three 10,000-kva., ten 6,000-kva., three 2,000-kva. and three 1,000-kva transformers for 60-cycle, single-phase service; one 5,000-kva., 4,000-volt synchronous condenser for three-phase, 60-cycle operation; 133 oil circuit breakers and seventeen lightning arresters. Most of this apparatus duplicates existing equipment and is to be used for making extensions in the system of the company.

Johns-Pratt Company Establishes Export Division in New York

The Johns-Pratt Company, Hartford, Conn., manufacturer of "Noark" fuses, meter-service and protective devices, has established an export division with office at 30 Church Street, New York City. E. Wilhelm Droosten and W. L. Urquhart, who have had extensive experience in handling export business of electrical manufacturers, will be in charge of this division.

The company also announces that arrangements have recently been made with the Curtin Mill Supply Company, Houston; Globe Supply & Machinery Company, New Orleans; Hide, Leather & Belting Company, Indianapolis; Hardy & Dischinger, Toledo; Rathbun Company, El Paso; Miller Supply Company, Huntington; Walworth-Ohio Company, Cleveland, and the Wayne Belting & Supply Company, Fort Wayne, as distributors for its power-plant specialties.

Starbuck Sprague Forms New Supply Jobbing House

A new electrical supply jobbing house has been organized at Waterbury, Conn., under the name of the Sprague Electrical Supply Company, quarters having been secured at 39 Spring Street, in the heart of the wholesale district. The company is a Connecticut corporation with an authorized capital of $112,500, and the officers are: President, Starbuck

Sprague; secretary, Weston M. Jenks; treasurer, R. G. Stewart; sales manager, Harry A. Squires.

The company has leased a three-story building with more than 4,000 sq.ft. on the main floor and over 2,000 sq.ft. on each of the two upper floors. The organization is launched to do a wholesale business without retail or contracting connections, and it will open with three men on the road, covering the Naugatuck Valley of Connecticut from Winsted to Ansonia and Derby, and from Danbury on the west to Southington and Cheshire on the east.

The company has been appointed distributor for Bryant, Johns-Pratt, Tubular Woven Fabric, Bryant-Marsh, Trumbull-Vanderpoel, Central Tube, Steel City, Federal Armored Cable and other products.

Mr. Sprague is widely known in New England electrical circles. He was graduated from Harvard College in 1907 and after two years in the electrical construction field spent seven years in the supply department of the General Electric Company and seven years as director and sales manager for the New England Engineering Company of Waterbury. Mr. Squires was graduated from Pratt Institute, Brooklyn, in 1916, and after two years with the Public Service Company of Northern Illinois spent five years with the New England Engineering Company.

Northwestern Electric Equipment Now Is Distributor Only

The Northwestern Electric Equipment Company, 174 East Sixth Street, St. Paul, Minn., will in the future confine its commercial efforts to the wholesale distribution of electrical, radio and telephone supplies, appliances and apparatus, including motors, switchboards, panels and cabinets.

J. M. Whalen and A. S. Abbott, with other former employees of the Northwestern firm, have purchased the company's interest in the Commonwealth Electric Company, the company's former manufacturing and repair departments, and will operate under the name of the Commonwealth Electric Company at 417 Broadway, St. Paul.

The retail department of the former Commonwealth Electric Company has been sold to E. S. Talmadge and C. J. Otterholm, who will continue that business under the name of the Commonwealth Appliance Company at 373 Robert Street.

Tungsten Light Manufacturer Buys Springfield Plant

The M. & W. Company, manufacturers of tungsten electric light bulbs, has bought a factory building from the Knox Motors Company, in Springfield, Mass., to which it will remove soon from its Taylor Street location. In place of paying four different rents in its present quarters, the concern will have a larger but more compact establishment comprising about 80,000 sq.ft. on four floors, enabling it to organize its business to good advantage and also expand to meet increased demands.

The new location is directly alongside the tracks of the New York, New Haven & Hartford's Highland division. The M. & W. Company is a licensee of the General Electric Company, and its production quota has of late been increased in a decided degree. C. F. Munder is president and treasurer of the company.

Electric Storage Battery to Sell Stock to Employees

The Electric Storage Battery Company, Philadelphia, announces that it has recently made arrangements by which employees may purchase shares of common stock. The plan enables employees to become stockholders under advantageous terms, keeping the payments down to easy monthly installments.

Under the plan, if the present rate of dividends—viz., $1 per share per quarter—continues, stock subscribed for at $53 per share will be fully paid for after forty months—that is, $40 per share will be the amount paid by the purchaser and $13 per share will be the amount credited from dividends. Any increase in the dividend rate or any extra dividends will reduce this time and the number of payments accordingly, and any reduction in dividends will make a corresponding increase over forty months.

The American Insulated Wire & Cable Company, 954 West Twenty-first Street, Chicago, will erect a one-story copper rod and wire plant, 105 ft. x 300 ft., at South Kedzie Avenue and Drainage Canal, to cost $100,000. It is said that the equipment will involve an investment of $200,000.

Stephen Hall & Company, Inc., formerly at 90 West Street, New York City, have moved to Seventh and Adams Streets, Hoboken, N. J., and the company has been incorporated to manufacture electrical machinery and equipment. Stephen M. Hall is president and Ross C. Pack is vice-president.

The Ward Manufacturing Company, 3047 Sheffield Avenue, Chicago, recently incorporated, announces that it will manufacture a line of electric toys, curling irons and grills. R. J. Rich is president of the company.

The Phoenix Light Company, 525 Market Street, Milwaukee, manufacturer of electric fixtures, has leased 20,000 sq.ft. of additional floor space at 529 Market Street. Joseph Sable is president and general manager of the company.

The Rawlplug Company, manufacturer of a special article for securing screws, has leased an entire floor at 66 West Broadway, New York City, where it will soon combine its general offices, now at 461 Eighth Avenue, and its sales office, now at 48 West Broadway. Stockroom facilities have been increased 600 per cent.

The Electrical Jobbers' Club announces the removal of its offices from 47 West Thirty-fourth Street, New York City, to 261 Broadway.

Hammer & Schwarz, engineers, announce the removal of their offices to 55 John Street, New York City.

The Instant Electric Water Heater Company, Bridgeport, Conn., recently formed, has leased property at Knowlton Street and East Washington Avenue for a new plant for the manufacture of electric water heaters. Equipment will be installed and operations commenced at an early date. The company is capitalized at $250,000 and will succeed to the business of the Bridgeport Manufacturing Company. H. E. Dineson is president.

The French Battery & Carbon Company, 2317 Winnebago Street, Madison, Wis., will soon have plans drawn for the rebuilding of the portion of its two-story-and-basement factory, recently destroyed by fire with loss approximating $30,000.

The Pittsburgh Transformer Company, Preble Avenue, Pittsburgh, Pa., has purchased property through its president, R. V. Bingay, at Metropolitan and Juniata Streets, at a price stated at $24,000. It is purposed to use the site for extensions.

The Indiana Manufacturing & Electric Company, Marion, Ind., recently organized, will manufacture electrical supplies, having taken possession of a plant at Twelfth and Race Streets.

The Heine Boiler Company, St. Louis, is enlarging its facilities to manufacture boilers of 2,000 hp. A tank-rolling machine and multiple drill have been ordered.

The Rumsey Electric Company, Philadelphia, electric supplies and machinery, announces the appointment of H. D. Baker in charge of its store at 1007 Arch Street.

The Bakelite Corporation, New York City, has acquired the plant formerly occupied by the Lake Erie Foundry & Vulcan Company, Painesville, Ohio, and will use it for the manufacture of phenol.

The Electric Rotary Machine Company, 40 South Clinton Street, Chicago, has purchased a two-story plant comprising 15,000 sq.ft. of floor space at 3825 West Lake Street.

The Air-Way Electric Appliance Corporation, Toledo, Ohio, announces the removal of its export sales department into larger quarters at 220 Broadway, New York City, where a complete array of its line has been arranged. N. M. Simons is the company's export manager.

The Bartlett Hayward Company, engineers, announces the removal of its New York office to 1607 Pershing Square Building, Forty-second Street and Park Avenue.

The New York Electrical Credit Association, New York City, announces the removal of its office from 47 West Thirty-fourth Street to 261 Broadway.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase or agency is desired in Morocco (No. 6,254) for electrical goods, etc.

An agency is desired in France (No. 6,256) for transformer oil, circuit-breaker oil, insulating tapes, mica-insulation substitutes and similar products.

Purchase is desired in Matanzas, Cuba (No. 6,300), of electric vacuum oven, medium size, voltage 220.

Purchase is desired in Chihuahua, Mexico (No. 6,309), of all machinery necessary to establish a modern bakery. Prices and illustrated catalogs are desired of gasoline or electrically heated ovens, kneeders, pans, etc.

Purchase is desired in Bilbao, Spain (No. 6,313), of an electric conveyor for iron ore, with a capacity of 1,000 tons per hour, over a distance of approximately 250 m.

SWITCHBOARD AND UNDERGROUND CABLE FOR AUSTRALIA.—Tenders will be received by the Postmaster-General's Department, Sydney, New South Wales, until June 21, for switchboard and multiple-twin underground cable and for telephone switchboard wire.

GENERATING UNIT FOR BULIMA, BRISBANE, AUSTRALIA.—Tenders will be received by the City Electric Light Company, Bulima, Brisbane, until Oct. 31 for one 12,500-kw. turbo-alternator unit at Bulima, Brisbane.

ELECTRIC LAMPS FOR MONTEVIDEO, URUGUAY.—Tenders will be received until June 12 by the State Electric Light Works, Montevideo, Uruguay, for 42,000 metal-filament electric lamps.

EXTENSION OF DISTRIBUTING SYSTEM OF THE MORWELL (AUSTRALIA) POWER SYSTEM.—The Victorian government has decided to appropriate £100,000 to enable the Victorian Electricity Commission, Melbourne, to extend the high-tension transmission lines and distribution lines to county centers desiring electricity from the Morwell plant. Applications have been received from sixteen rural municipalities desirous of taking advantage of the proposed service.

JAPANESE ELECTRIC COMPANY TO RESUME CONSTRUCTION.—The Japanese government, *Commerce Reports* states, is reported to have decided to provide the Taiwan Electric Power Company with funds to enable it to continue construction of the generating plant on which work has been temporarily suspended. The original plans called for a plant of 100,000-kw. capacity, to cost 40,000,000 yen (1 yen = $0.4985). These plans have been modified and it is now estimated that the total amount required will be 30,000,000 yen.

New Apparatus and Publications

AUTOMATIC CUTTING MACHINE.—The Artos Engineering Company, 306 Milwaukee Street, Milwaukee, has added style "KN" No. 3 to its line of the "Artos" automatic measuring and cutting machines.

FUSE CUT-OUT.—Bulletin No. 201 issued by Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, covers its "S. & C." style "DP" fuse cut-out.

INSULATOR TESTER.—James G. Biddle, 1211-13 Arch Street, Philadelphia, has issued pocket manual No. 1010, entitled "Concerning Insulation Testing, with Special Reference to the Meg."

SLUICEGATES.—The Champion Engineering Company, Kenton, Ohio, is distributing five leaflets illustrating the "Caterpillar" type sluicegates manufactured by the company under "Broome" patents.

INSULATING MATERIALS.—The Mica Insulator Company, 68 Church Street, New York City, is distributing a revised price list and discount sheet covering its electrical insulating materials.

LIGHTNING ARRESTERS.—Bulletin No. 204 distributed by Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, covers the various types of the "S & C" lightning arresters.

LIQUID STARTERS FOR MOTORS.—The Brush Electrical Engineering Company, London, England, has recently brought out a liquid starter for electric motors. This new invention, it is claimed, diminishes resistance gradually and continuously and so eliminates the shocks and sudden variations of resistance characteristic of the usual metallic type of starters.

TRANSFORMER THERMAL INDICATOR.—A new device, known as the transformer thermal indicator, has been placed on the market by the Westinghouse Electric & Manufacturing Company to indicate the temperature of the hot oil in distribution transformers.

BATTERY TEST BOARD.—The Reliance Instrument Company, 1135 West Van Buren Avenue, Chicago, has placed on the market a portable high-rate discharge battery test board for bench use in service stations for testing automobile batteries.

CANOPY SWITCH.—The Arrow Electric Company, Hartford, Conn., has placed on the market a canopy switch with a ratchet handle which, it is stated, can be turned backword without injuring the mechanism.

LIGHTING FIXTURES.—A new lighting fixture, designed particularly for stores, known as "Magic-Lite," has been brought out by the Brascolite Company, St. Louis.

New Incorporations

THE GROVELAND (FLA.) LIGHT, POWER & ICE COMPANY has been incorporated with a capital stock of $30,000. The officers are Harry Merck, president, and W. M. Cathrae, vice-president.

THE M. & F. POWER COMPANY has been chartered with a capital stock of $35,000 by W. S. Fant, S. Friend and O. H. Bright.

THE ROSCOE ELECTRIC COMPANY, Janesville, Wis., has been incorporated with a capital stock of $5,000 to generate and distribute electricity. The incorporators are William H. Daugherty, Stanley M. Ryan and Paul Grubb.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

AUGUSTA, ME.—The Maine Central Power Company will construct an addition to its substation, 30 ft. x 50 ft.

PORTLAND, ME.—A power house will be constructed at the high school to be built in the Deering district, to cost about $700,000.

MANCHESTER, N. H.—The Public Service Commission has granted the Manchester Traction, Light & Power Company permission to issue $676,700, the proceeds of $639,500 to be used to pay for extensions made prior to Jan. 1, 1923, the remainder to be used for further improvements.

EVERETT, MASS.—The Merrimac Chemical Company, Broadway, will build an addition to its power house.

HOLYOKE, MASS.—The Board of Aldermen has authorized an appropriation of $1,000,000 for a new municipal electric steam generating plant. An appropriation of $100,000 was also authorized by the Aldermen from money now available for the purchase of a site for the proposed new electric plant.

PAWTUCKET, R. I.—Negotiations are under way between the City Council and the officials of the Blackstone Valley Gas & Electric Company for the installation of an ornamental lighting system in the business district.

Middle Atlantic States

ALEXANDRIA BAY, N. Y.—The installation of an ornamental lighting system, to cost about $50,000, is under consideration by the special lighting committee of the Thousand Island Yacht Club. Further information may be obtained of J. L. Kincaid, 643 West Onondaga Street, Syracuse.

AMSTERDAM, N. Y.—The Adirondack Power & Light Corporation contemplates building a dam and power house on East Canada Creek at Stewarts Landing, to cost about $175,000.

BROOKLYN, N. Y.—The Brooklyn Edison Company will build a substation, 52 x 79 ft., at 179 Hudson Avenue, to cost about $100,000.

BUFFALO, N. Y.—Electric power equipment will be installed in the proposed municipal market building, 50 ft. x 275 ft., to be constructed by the Department of Parks and Public Buildings, on Market Street. Howard L. Beck is architect for the department.

CHARLOTTE, N. Y.—Electric power equipment will be installed in the ice and cold-storage plant to be constructed by the Charlotte Cold Storage Company, to cost about $250,000. John Strobel, E. & B. Building, Rochester, is architect.

CORNWALL, N. Y.—The Cornwall Chemical Company plans to rebuild its power house and factory recently destroyed by fire with loss of about $100,000.

GLOVERSVILLE, N. Y.—The Board of Public Works contemplates the installation of an ornamental lighting system on several streets, to cost from $30,000 to $35,000.

NEW YORK, N. Y.—The Commercial Solvents Corporation, 17 East Forty-second Street, will build a power house in connection with a proposed plant, to cost about $750,000.

OGDENSBURG, N. Y.—The Ogdensburg Power & Light Company plans to erect a building for general operations at Caroline and Ford Streets, to cost about $150,000.

PEEKSKILL, N. Y.—The N. Dains Sons' Company plans to rebuild its power house and lumber plant, recently destroyed by fire, causing a loss of about $200,000.

ROCHESTER, N. Y.—The Rochester Gas & Electric Corporation plans to erect a transformer station at 26 Swan Street, to cost about $40,000.

ROME, N. Y.—The Manufacturers' Power Corporation is considering the construction of a power house on the barge canal and erecting high-tension transmission lines, to cost about $100,000.

TONAWANDA, N. Y.—The R. T. Jones Lumber Company contemplates the construction of a power house in connection with a new lumber plant to be erected on Tonawanda Island.

MILLVILLE, N. J.—The Whitall-Tatum Company will install electric power equipment in connection with the rebuilding of its local glass plant, recently damaged by fire. The loss is estimated at $400,000.

WEEHAWKEN, N. J.—The Cunard Steamship Company, Ltd., 25 Broadway, New York, plans to erect an electric power house in connection with building four 1,000-ft. piers on the Hudson River, to cost about $3,500,000.

BETHLEHEM, PA.—Bids will be received until May 15 for the construction of a power house at the new plant of the Confederated Home Abattoir Company on the Mauch Chunk Road. A refrigerating plant will also be installed. The cost of the entire work is estimated at $350,000. The Gorman-Brown Engineering Corporation, 40 Rector Street, New York City, is engineer.

HOLTWOOD, PA.—The Pennsylvania Water & Power Company is building a 60-cycle system to be completed in 1923. The work will include the installation of two I. P. Morris turbines of 20,000 hp. capacity each; two Westinghouse generators, each of 15,000 kva., 13,200 volts, three-phase; two General Electric frequency changers of 5,000 kw. capacity each; the erection of a double steel tower, 73,000-volt transmission line to York, designed ultimately for 110,000 volts, and a substation at York with an initial transformer capacity of 10,000 kw., where energy will be supplied to the Edison Light & Power Company; also a double-circuit steel-tower, 73,000-volt transmission line to Coatesville, where electricity will be supplied to the Chester Valley Electric Company, to be delivered at a substation to be erected by the latter. James L. Rintoul is treasurer.

MAHONOY CITY, PA.—The Ball Lumber Company plans to rebuild its power house and mill, recently destroyed by fire, with a loss of about $85,000.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 22 for miscellaneous motor-generator panels and auxiliary equipment. (Schedule 788.)

PHILADELPHIA, PA.—The Largman Gray Company, 3360 Frankford Street, will build a power house at its proposed textile mill on Kensington Avenue, to cost about $300,000.

PITTSBURGH, PA. — The West Penn Power Company has issued $500,000 in capital stock, the proceeds to be used for extensions and equipment in its generating plants.

BALTIMORE, MD.—The United States Industrial Alcohol Company, Curtis Bay, plans to install a power house in connection with a new plant to cost about $700,000.

BALTIMORE, Md.—Plans have been prepared by the Board of Works, for a central power plant for city service, to be built in conjunction with a police station at Lexington and Gay Streets, to cost about $500,000. Lawrence H. Fowler, 307 North Charles Street, is architect.

HAGERSTOWN, MD. — The Maryland Public Service Company was recently organized by officials of the American Water Works & Electric Company, New York, to take over the systems of the Potomac Public Service Company, Hagerstown, and the Cumberland (Md.) Edison Company. Bonds to the amount of $3,983,000 have been authorized to carry out the consolidation and for extensions and improvements to the systems.

CHARLESTON, W. VA.—Electric power equipment, refrigerating machinery, etc., will be installed in the new market building to be erected by the Charleston Market Company, to cost about $400,000.

MORGANTOWN, W. VA.—Preparations are being made by the West Virginia Power & Transmission Company, a subsidiary of the West Penn Power Company, for the construction of a hydro-electric plant on the Cheat River at State Line. Rights of way for a transmission line from the proposed dam to Morgantown and Fairmont are being purchased.

HOPEWELL, VA.—The Hopewell China Company contemplates rebuilding its power plant, recently destroyed by fire with loss of about $100,000.

SHENANDOAH, VA. — The Norfolk & Western Railway Company, Roanoke, plans to install a power house at its proposed local car and locomotive repair shops, to cost about $450,000.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until May 22 for 250 transformer coils and 100 mica condensers. (Schedule 787.)

North Central States

CARO, MICH.—The Great Lakes Company, Bad Axe, has purchased the local electric plant, owned by the Consumers' Power Company, Jackson.

ERIE, MICH.—The Père Marquette Railroad Company, Detroit, will build a power house in connection with its proposed local car and locomotive shops, to cost about $1,000,000.

KALAMAZOO, MICH.—The El-Mora-Lee Paper Company, 839 Lake Boulevard, Kalamazoo, Mich., will build a power house in connection with its proposed paper mill in Howlandsburg, to cost about $400,000.

RED JACKET, MICH.—The installation of an ornamental lighting system on Fifth and Oaks Streets is under consideration.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, until May 18 for cedar poles for the division of light and power. Separate bids will be received at the same time and place for electric meters, and also for fiber conduit, for the division of light and power.

FREMONT, OHIO.—A company has been organized by farmers along the Port Clinton road for the purpose of securing electric service from the Ohio Light & Power Company.

SHELBY, OHIO.—The Council has appropriated $6,500 for equipment for the municipal electric plant, including two boilers of 300 hp. capacity each.

FLEMINGSBURG, KY.—The Maysville Gas Company contemplates the erection of an electric transmission line to Flemingsburg and purchasing the local distribution system. The city at the present time is without street-lighting service.

WHITESBURG, KY. — The Blue Ridge Diamond Coal Company plans to install electric power equipment at its coal properties. A lumber mill with power house is under consideration.

CLINTON, IND. — The Wabash Valley Electric Company is negotiating for the purchase of the properties of the Martinsville Gas & Electric Company, Spencer Light, Power & Water Company, Putnam Electric Company, Cayuga Electric Company, Roachdale Electric Company, Gosport Electric Company and the Morgan County Light & Power Company. The systems will be merged and extensions and improvements made. Bonds to the amount of $1,561,700 have been authorized to carry out the consolidation and to provide funds for expansion.

INDIANAPOLIS, IND. — Arrangements are being made by the Lavelle Foundry Company, Michigan Street and the Belt Railway, for equipping its plant for electrical operation.

NEW HARMONY, IND.—Plans are being considered for improvements and extensions to the municipal light and power plant, to cost about $60,000.

VINCENNES, IND.—The Indiana Power Company has issued $1,000,000 in capital stock, the proceeds to be used for extensions and improvements, including a 10,000-kw. addition to the local plant.

BLOOMINGTON, ILL.—Bids, it is reported, will soon be asked for the installation of an ornamental lighting system on Washington Street, to cost $6,736.

EDWARDSVILLE, ILL. — Plans are under consideration to replace the arc lamps in the business district (covering about 2 miles) with an ornamental lighting system

LINCOLN, ILL. — Extensive improvements are contemplated by the Lincoln Water & Light Company involving an expenditure of about $143,000. Contracts have been placed for a 1,500-kva. turbo-generator and condenser.

ST. CROIX FALLS, WIS.—The Railroad Commission has granted the St. Croix Falls Improvement Company permission to raise and rebuild the Nevers Dam across the St. Croix River. The new dam, it is estimated, will develop about 30,000 hp.

SALEM, WIS. — The Carey Electric & Milling Company, Wilmot, will make extensions and improvements to its local system as suggested by the Railroad Commission.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company contemplates extensions and improvements to its local properties involving an expenditure of about $200,000. The plans include an addition to power house and installation of additional generating units.

WEST ALLIS, WIS.—The City Council has authorized the installation of an ornamental lighting system on Greenfield Avenue, to cost about $14,000.

FERGUS FALLS, MINN. — Among the improvements contemplated by the Ottertail Power Company this summer is the construction of two large power dams on the Otter Tail River at Fergus Falls and the erection of another large steam power plant. The cost of the work is estimated at about $500,000.

MINNEAPOLIS, MINN.—Plans are being considered by the Board of Park Commissioners for the erection of 244 electric lamp standards along Minnehaha Parkway, to cost about $35,000.

ST. PAUL, MINN.—Improvements contemplated by the St. Paul Gas Light Company during 1923 include replacing six rotaries of 1,500 kw. capacity with two motor-generator sets having a total capacity of 2,000 kw., installing three 300-kw. transformers and starting construction work on the first 25,000-kva. unit of its proposed new steam-driven generating plant. F. C. Hoffman is secretary.

SLAYTON, MINN.—The Slayton Power Company has contracted with the Northern States Power Company for electricity, the service to begin about June 1. F. H. Eddy is owner of the local system.

CENTERVILLE, IOWA. — The Iowa Southern Utilities has issued $1,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

RIVERSIDE, IOWA.—The Sioux (Iowa) City Brick & Tile Company plans to build a power plant at its proposed local factory, to cost about $100,000.

SIOUX CITY, IOWA. — Options have been obtained by the Sioux City Gas & Electric Company on about 15 acres of land in the North Riverside section of the city as a site for its proposed new plant.

HOPKINS, MO.—The Maryville Electric Light & Power Company is planning to extend its transmission line to Hopkins to furnish electrical service here. The local plant was recently burned down.

GREENFIELD, MO.—The South Missouri Power Company plans to erect a transmission line to Golden City to furnish electricity there. The company also contemplates extending its service to South Greenfield, Lockwood and Everton.

ORAN, MO.—At an election to be held May 15 the proposal to issue $23,000 in bonds for installation of an electric lighting system will be submitted to the voters.

SIOUX FALLS, S. D.—The Minnesota Electric Distributing Company and the Tri-State Utilities Company, Eldora, Iowa, are promoting the erection of a high-tension transmission line from Gayville, S. D., to Wynot, Neb., from which point two branch lines will be built. Practically every town in Cedar, Dixon and Knox Counties will be served by the new lines. Arrangements are being made to take over the electric plant now furnishing electricity in these localities.

Southern States

GREENSBORO, N. C.—Plans are being prepared for a power plant for the Agricultural and Technical College to cost about $55,000. Harry Barton, Greensboro, is architect.

MARION, N. C.—The Marion Lake Club plans to install an electric light and power plant.

OAKBORO, N. C.—The Oakboro Cotton Mill plans to install a power plant in connection with a proposed local textile mill, to cost $225,000.

WALNUT COVE, N. C.—Plans are under consideration by the Council for the installation of a municipal electric light plant

WASHINGTON, N. C.—The J. M. Swindell Company will build a power house in connection with a proposed packing factory and ice plant, to cost about $100,000.

CLEARWATER, FLA.—Plans are being considered by the Clearwater Cooperage Company for the installation of a power plant in connection with a proposed local plant, to cost about $100,000. C. E. Murray is president.

CRESTVIEW, FLA.—Bids will be received by the Common Council until May 28 for a 40-kw. generator, exciter, switchboard and equipment for distributing system, etc., for a municipal electric plant. J. D. Carter, Geneva, Ala., is engineer.

GREENVILLE, FLA.—Bonds for $30,000 have been voted for extensions and improvements to the municipal lighting system and waterworks.

MIAMI BEACH, FLA.—Bonds to the amount of $20,000 have been voted for the installation of an ornamental lighting system.

MILAN, TENN.—Plans are under consideration for extensions and betterments to the municipal electric plant, to cost about $40,000.

HEFLIN, ALA.—W. M. Dobson, Wedowee, it is reported, contemplates installing an electric plant in Heflin. The local electric plant was recently destroyed by fire.

PELHAM, ALA.—The Superior Lime & Hydrate Company contemplates the construction of a power house at its local plant.

LITTLE ROCK, ARK.—The Arkansas Central Power Company, recently organized to take over the local properties of the Little Rock Railway & Electric Company, has issued $2,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

BATON ROUGE, LA.—The Baton Rouge Electric Company contemplates extensions and improvements during the next eighteen months, to cost about $1,000,000. The plans include an addition to the local power plant to cost approximately $300,000. New equipment, including a 3,000-kw. generator, will be installed.

LAFAYETTE, LA.—The Southern Pacific Railroad Company plans to build a power house at its new local shops now in course of erection.

KIEFER, OKLA.—The Oklahoma Gas & Electric Company is planning to erect a transmission line from Kiefer to Nuyaka, via Mounds, a distance of 20 miles.

McALESTER, OKLA. — The Choctaw Power & Light Company contemplates erecting a high-tension transmission line from McAlester to Savanna, Kiowa, Stringtown, and possibly to Atoka, a distance of about 50 miles.

AMARILLO, TEX.—The City Light & Water Company has contracted with the municipality for the installation of an ornamental lighting system in the business district.

DEWEYVILLE, TEX.—The Peavy-Moore Lumber Company plans to construct a power house in connection with a new lumber mill, to cost about $500,000.

URBANA, TEX.—The Urbana Sand & Gravel Company will install a power house at its plant. The equipment will include a 60-kw. generator.

Pacific and Mountain States

TACOMA, WASH.—Plans are being prepared by J. L. Stannard, engineer, Balboa Building, San Francisco, for two power houses, one of 30,000 hp. capacity, the other of 45,000 hp., storage dam, etc., and transmission lines in connection with the Lake Cushman power project for the city of Tacoma.

VANCOUVER, WASH.—Work will soon begin by the Pudget Sound Power & Light Company, Seattle, on the erection of a high-tension transmission line between Woodland and Vancouver.

YARDLEY, WASH.—The Western Cedar Pole Preserving Company contemplates building a power plant in connection with its local plant, to cost about $100,000.

ASTORIA, ORE.—Surveys are being made by the Crown Willamette Paper Company with a view of developing the water power at Young's River Falls to operate its pulp mill there.

ASTORIA, ORE.—The installation of a new local heating and power plant is under consideration by the Consumers' Central Heating Company, Tacoma, Wash.

BAKER, ORE.—The Eastern Oregon Light & Power Company plans to build a 1,500-hp. steam-driven electric plant in Baker, estimated to cost about $100,000.

MILTON, ORE.—Permission has been granted to K. C. Harlan, Walla Walla, Wash., to utilize the water power of the Walla Walla River above Milton. Mr. Harlan proposes to furnish water to irrigate 10,000 acres of land and to develop 4,000 hp.

EUGENE, ORE.—Plans have been prepared for the construction of a new power house for the University of Oregon, to cost about $75,000. Bids, it is understood, will soon be asked for the work.

NORTH BEND, ORE.—The City Council is considering the establishment of a municipal electric light plant and waterworks system.

ROSEBURG, ORE.—Plans are being prepared by the City Council for the installation of an ornamental lighting system in the business district, to cost about $10,000.

AUBURN, CAL.—The Bear River Water & Power Company has been granted permission to construct a hydro-electric generating plant on the Bear River.

MODESTO, CAL.—The Modesto Irrigation District has been granted permission by the State Water Board to construct and operate a 17,000-hp. hydro-electric power plant on the Tuolume River, Stanislaus County, to cost about $360,000.

SAN FRANCISCO, CAL.—Bids will be received by the Board of Public Works of the city and county of San Francisco, San Francisco, until May 23 for furnishing and installing steel penstocks and accessories for the Moccasin Creek power plant, contract No. 91, Hetch Hetchy water supply. Specifications may be obtained at the office of M. M. O'Shaughnessy, city engineer, City Hall.

Canada

VICTORIA, B. C.—The British Columbia Electric Company contemplates extending its transmission line from Bamberton to the Duncan, Cowichan and Ladysmith districts.

CLACE BAY, N. S.—The Town Council is considering an appropriation of $32,950 for extensions to the municipal electric system.

PORT ARTHUR, ONT.—The erection of a second transmission line from Cameron Falls to Port Arthur and the installation of an additional generating unit is under consideration by the Hydro-Electric Power Commission.

QUEBEC, QUE.—Plans have been submitted to the Provincial Cabinet by the Running Streams Commission for the construction of a dam on the Metis River in Matan County, to cost about $200,000. The Compagnie du Bas St. Laurent is interested in the project.

QUEBEC, QUE.—The Lower St. Lawrence Power Company has petitioned the Public Service Commission for permission to erect electric transmission lines in Rimouski and Matane Counties.

QUEBEC, QUE.—The Quebec Provincial Government has awarded the Des Quinze power lease to W. Alexander Fasken, Toronto, a director of the Northern Ontario Light & Power Company, Ltd., Cobalt, Ontario, at an annual rental of $80,100. The Des Quinze power project consists of fifteen rapids near the head of Lake Temiskaming and is capable, it is said, of developing 60,000 hp.

Electrical Patents

Announced by U. S. Patent Office

(Issued April 17, 1923)

1,452,267. CONNECTING DEVICE FOR ELECTRIC CIRCUITS; S. M. Esler, Chicago, Ill. App. filed Aug. 7, 1919. Two-way adaptor for lamp sockets.

1,452,269. TELEPHONE-EXCHANGE SYSTEM; C. L. Goodrum, New York, N. Y. App. filed April 17, 1920. Machine-switching selecting means.

1,452,277. TELEPHONE SUBSTATION SET; K. S. Johnson, Jersey City, N. J. App. filed Oct. 8, 1917. Arranging elements of local battery set for maximum efficiency.

1,452,281. METALLIZING ARTICLES; Q. Marino, Hampstead, London, England. App. filed Sept. 10, 1921. Electrodepositing metallic coating on article.

1,452,304. COLLAPSIBLE ELECTRIC HEATER; E. J. McCormack, San Francisco, Cal. App. filed July 13, 1921. Of reflector type.

1,452,311. HEATING DEVICE FOR LIQUIDS; C. E. Parkhurst, Somerville, Mass. App. filed March 11, 1922. Automatic temperature control.

1,452,321. ADAPTER. L. Stendahl, Fairfield, Conn. App. filed March 31, 1922. For use in lamp sockets

1,452,323. TOLL TRUNKING CIRCUITS FOR MACHINE-SWITCHING TELEPHONE SYSTEMS; R. L. Stokely, Floral Park, N. Y. App. filed March 1, 1921. Method of collecting and returning coins to subscribers.

1,452,327. POWER-TRANSMISSION ARRANGEMENT; M. E. Thompson, Ridgway, Pa. App. filed Dec. 20, 1919. Magnetic coupling for engine and motor drive in submarines.

1,452,334. TELEPHONE RECEIVER; C. T. Baisley, North Edgecomb, Me. App. filed May 11, 1922. Watchcase type.

1,452,339. ELECTRICAL DISCHARGE DEVICE; R. A. Heising, East Orange, N. J. App. filed May 28, 1918. Tubes of audion type which function as generators.

1,452,399. RADIO VARIABLE RHEOSTAT; H. W. Tompkins, Greensburg, Pa. App. filed Aug. 2, 1922.

1,452,472. CONTROLLER FOR MOTORS; C. W. Plehaty, White Plains, N. Y. App. filed Jan. 25, 1922. Manually operated starting box.

1,452,484. METHOD OF GUNFIRE CONTROL FOR BATTLESHIPS; E. A. Sperry, Brooklyn, N. Y. App. filed Sept. 30, 1916. Gyroscopic apparatus.

(Issued April 24, 1923)

15,584 (reissue). DIRECTION SIGNAL FOR AUTOMOBILES; W. W. Lincoln, Washington, D. C. App. filed Oct. 7, 1920.

1,452,500. BURGLAR-ALARM APPARATUS; B. Galerman, Philadelphia, Pa. App. filed Oct. 15, 1918.

1,452,511, 1,452,512 and 1,452,513. ELECTRIC RIVET HEATER; W. S. Johnson and J. W. Sheffer, Berwick, Pa. App. filed Aug. 17, 1920. Transformer for heating rivets and hood for protecting heater against elements.

1,452,527. TRANSMITTING APPARATUS FOR ELECTRIC TELEGRAPHS; L. M. Potts, Baltimore, Md. App. filed Dec. 14, 1915. Motor-driven telegraph transmitter.

1,452,528. BRAKE; J. M. Rohlfing, Plainfield, N. J. App. filed April 15, 1922. Electrically operated motor brake.

1,452,550. CIRCUIT INTERRUPTER; O. H. Eschholz, Wilkinsburg, Pa. App. filed Aug. 18, 1921. Water resistance inserted to reduce current.

1,452,573. ELECTRODEPOSITION OF TIN; L. D. Simpkins, Brooklyn, N. Y. App. filed Feb. 10, 1922. Electrolytic bath containing tin-salt solution, beta-naphthol and a colloid.

1,452,574. CIRCUIT INTERRUPTER; J. Slepian, Wilkinsburg, Pa. App. filed June 29, 1918. Resistance inserted to reduce current.

1,452,587. REGULATING AND CIRCUIT-CONTROLLING APPARATUS; E. J. Blake, Buffalo, N. Y. App. filed Oct. 14, 1920. For storage battery-generator lighting equipment.

1,452,589. ELECTROLYTIC CELL; D. A. Brading, Chicago, Ill. App. filed Sept. 23, 1922. For making hydrogen and oxygen gas.

1,452,590 and 1,452,591. ELECTRICAL MEASURING INSTRUMENT; I. W. Brogger, Newark, N. J. App. filed April 26, 1919. Ammeter of solenoid type.

1,452,610. ELECTRICAL CONDENSER; M. Klosner, New York, N. Y. App. filed Sept. 2, 1920. Variable plate condenser.

1,452,615. WIRE-ASSEMBLING MACHINE; R. A. Pigeon, Akron, Ohio, App. filed May 8, 1920. Machine cuts and assembles wires for various circuits in automobile.

1,452,651. TARGET FINDER FOR FIREARMS; C. H. Norrlin, New York, N. Y. App. filed Oct. 15, 1921. Flashlight attached to barrel.

1,452,666. DEVICE FOR THE COOLING OF ELECTRIC APPARATUS BY THE CIRCULATION OF LIQUID THROUGH THE CONDUCTORS; P. G. M. Toulon, Paris, France. App. filed May 2, 1922. Fluid-cooled secondary winding of a transformer so combined with fluid-cooled anodes of vapor rectifier that cooling of both is effected simultaneously.

1,452,678. APPARATUS FOR REMOVING THE DIVISION PLATES FROM ICE-CREAM RECEPTACLES; H. Dilas, Bay City, Mich. App. filed Jan. 12, 1922. Plates heated electrically.

1,452,681. AUTO SIGNAL; M. Fujimoto and T. Okawa, Portland, Ore. App. filed May 21, 1920. Rear-direction signal apparatus.

1,452,688. VOLTAGE-CONTROLLING DEVICE FOR DYNAMOS; G. C. Hubble, Bonners Ferry, Idaho. App. filed Dec. 2, 1921. Automatic or manual control of field current.

1,452,737. SIGNALING DEVICE; F. M. Hill, Chicago, Ill. App. filed Oct. 1, 1917. For railway crossings.

1,452,752. PANELBOARD CONSTRUCTION; E. A. Olley, Syracuse, N. Y. App. filed June 13, 1918. Circuit-carrying parts assembled as unit before attaching to panelboard base.

1,452,762. ELECTRIC SEAM-WELDING MACHINE; E. Schroder, Berlin, Germany. App. filed March 15, 1920. For welding longitudinal seams of tubes.

1,452,781. WELDING ROD; F. M. Becket, Niagara Falls, N. Y. App. filed June 28, 1921. Iron alloy containing carbon, manganese and silicon.

1,452,806. STORAGE-BATTERY VENT; N. M. Hopkins, New York, N. Y. App. filed May 31, 1921. Prevents leakage of electrolyte.

1,452,813. METHOD OF DECOMPOSING MIXED SALT SOLUTIONS; H. Pauling, Berlin-Grunewald, Germany. App. filed Aug. 3, 1921. By electrolysis.

1,452,814. INCLOSED-SWITCH CONSTRUCTION; C. F. Platt, Bridgeport, Conn. App. filed June 27, 1922. To facilitate installation and replacement of fuse plugs without opening box.

1,452,827. TELEPHONE DEVICE; L. de Forest, New York, N. Y. App. filed Nov. 22, 1919. Combined loud speaker and table lamp in which shade acts as diaphragm.

1,452,849. WIRELESS TRANSMITTING STATION; H. J. Round, London, England. App. filed Dec. 13, 1921. Sending different wave lengths simultaneously.

1,452,850. TELEPHONE APPARATUS; L. Schmidt, Brooklyn, N. Y. App. filed June 26, 1922. Loud-speaking receiver for wireless telephone.

1,452,851. HEAD RECEIVER FOR TELEPHONES; L. Schmidt, Brooklyn, N. Y. App. filed Sept. 30, 1922. Head band for two receivers.

1,452,857. SYSTEM OF VOLTAGE CONTROL; L. S. Uphoff, U. S. Army. App. filed June 26, 1919. For use with X-ray machines.

1,452,877. SYSTEM OF DISTRIBUTION; G. E. Hulse, Newark, N. J. App. filed Dec. 9, 1918. Railway-car battery-generator lighting equipment.

1,452,903. STATION SELECTOR; O. K. Bakken, Northwood, N. D. App. filed Jan. 30, 1920. Selective ringing device for party-line exchanges.

1,452,925. WIRELESS-TELEGRAPH CALLING DEVICE; W. H. Nottage and T. D. Parkin, Chelmsford, England. App. filed Dec. 18, 1920. Impulses transmitted at regular intervals and received by balance-wheel relay.

1,452,927. GATHERING REEL; G. W. Packer, Chicago, Ill. App. filed July 30, 1920. Adapted to mining locomotives.

1,452,933. SELECTIVE AMPLIFYING APPARATUS; M. I. Pupin, Norfolk, Conn. App. filed Oct. 10, 1918. Selective multi-step vacuum-tube amplifier.

1,452,934. ZINC SMELTING FURNACE; B. Raeder, Kykkelsrud, Askim Station, Norway. App. filed Feb. 5, 1920. Preliminary drying and heating before feeding reduction chamber.

1,452,936. METHOD OF AND APPARATUS FOR WELDING; F. J. Schuman, Cleveland Heights, Ohio. App. filed March 31, 1920. For repairing steel and iron castings.

1,452,939. COIL; C. Sparks, Oak Park, and W. G. Shull, Chicago, Ill. App. filed Jan. 9, 1920. Repeating coils for telephone apparatus.

1,452,942. CHAIN-LINK WELDING; E. Thomson, Swampscott, Mass. App. filed March 16, 1921. Done by machine.

1,452,954. PACK FOR ELECTRICAL HEATING ELEMENTS; W. A. Braun, Dover, Ohio. App. filed April 18, 1922. For embedding and insulating resistance wires and irons.